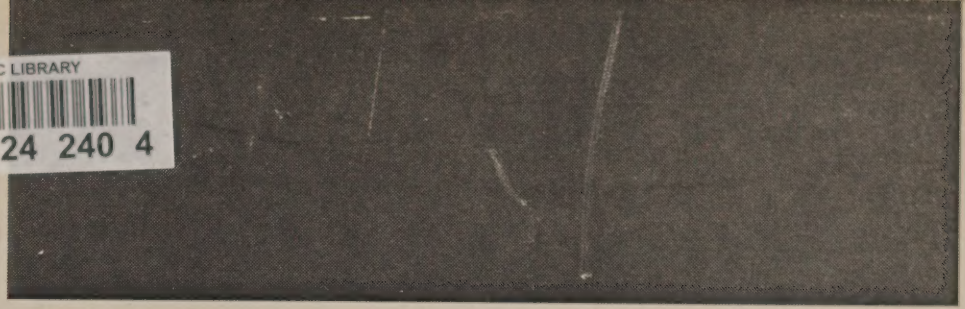


BRA

Draft Environmental Assessment

99 State Street/ Kilby Street Garage Project

A
M3/B16
RA
85/57

Submitted to the
Boston Redevelopment Authority

Project Proponent
99 State Street
Limited Partnership

Prepared by
Skidmore, Owings & Merrill
Vanasse/Hangen Associates, Inc.

Roger Lang
Wright Brothers Facility, MIT

May 1985

BOSTON
REDEVELOPMENT
AUTHORITY

Stephen Coyle/*Director*

One City Hall Square
Boston, MA 02201
(617) 722-4300

May 20, 1985

Councillor Brian J. McLaughlin
City Council
City Hall
One City Hall Square
Boston, MA 02201

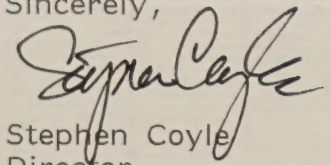
Dear Councillor McLaughlin:

The Boston Redevelopment Authority (BRA) currently is reviewing a proposal to redevelop the City-owned Kilby Street garage and adjacent parcels. As part of the BRA's review, 99 State Street Limited Partnership has prepared a draft environmental assessment report which I have enclosed for your review.

The content of a final BRA environmental assessment to be prepared by the proponent will be determined, in part, on the basis of comments received by the Authority. I hope you will review the report and I urge you to submit written comments to me on or before June 5, 1985.

Thank you for your time and interest.

Sincerely,



Stephen Coyle
Director

99 STATE STREET/KILBY STREET GARAGE PROJECT

BRA Draft Environmental Assessment

May 1985

Submitted to the Boston Redevelopment Authority

Project Proponent--99 State Street Limited Partnership

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Wright Brothers Facility, MIT

Contents

Exhibits

I Summary

99 STATE STREET/ KILBY STREET GARAGE PROJECT	The 99 State Street Project involves the redevelopment of a 1.37 acre area in the financial district of downtown Boston. The project fronts on portions of State Street and Kilby Street, and is located on a site currently occupied by the Kilby Street Parking Garage, a vacant lot, and several older commercial buildings in varying physical condition. The project will result in the creation of a 700,000 square foot office building comprised of a low-rise base structure fronting the edges of the site, and a tower element set back from street frontage. The project includes 15,000 square feet of retail uses located primarily along Kilby and State Street and within a ground-level retail arcade oriented to Merchants Row, a primary pedestrian link between the financial district and Quincy Market. Up to 700 on-site parking spaces below grade are currently planned for the development. Garage access/ egress will be from Broad Street via a depressed ramp on a portion of what is now Doane Street, which will be closed. Loading and receiving will occur at Kilby Place, away from traffic utilizing surrounding streets. Pedestrian connections established by the project will reflect the area's history of through-block pedestrian walkways. These connections will include a link between Merchant's Row and the project's retail arcade, and a link between Kilby Street and Broad Street via a walkway aligned with Central Street and Exchange Place. Streetscape improvements to be created in the vicinity of the site will be planned in conjunction with the Boston Redevelopment Authority.
PROPONENT	99 State Street Limited Partnership
DOCUMENT STATUS	BRA Draft Environmental Assessment
ALTERNATIVES	Each development alternative is comprised of 685,000 square feet of office space and 15,000 square feet of retail space. The ground floor configuration of each

alternative is identical. The principal differences between these alternatives is the configuration of the base and tower elements, as described in the following summary:

	Base Element Height	Tower Element Height (including base)
Alternative 1	116 feet 9 stories	238 feet to parapet 263 feet to mechanical 19 stories
Alternative 2	67 feet 5 stories	370 feet to parapet 395 feet to mechanical 30 stories
Alternative 3	67 feet 5 stories	410 feet to parapet 435 feet to mechanical 33 stories

TRAFFIC AND PARKING

Existing daily traffic to and from the site has been extimated at 1,050 trips. A comparison of this existing level of traffic with the projected new trip rate of 1,726 trips per day indicates an increase of approximately 676 trips. The impact of the traffic to be generated by the project varies by location. Assuming relocation of the access to the garage from Kilby Street to Broad Street means an overall reduction in daily traffic on Kilby Street of approximately 39 percent, and an increase in daily traffic on State Street of approximately 8 percent.

WATER AND SEWER SERVICE

The project area is served by combined sewers, and by the East Side Interceptor which is currently undergoing reconstruction scheduled for completion in 1989. Increased sewage flow to be generated by the project has been estimated at 41,625 gallons per day. The capacity and flows of the Broad Street combined sewer pipe will be investigated to determine whether it can adequately carry flows from the project to the Central

Street combined sewer, leading to the East Side Interceptor. To avoid contributing to surcharged conditions in the East Side Interceptor during high-tide periods, a storage tank system will be utilized to hold sewage on-site until low-tide periods.

Options for relocating a portion of the Central Street sewer now located within the project site are currently being investigated. Any rebuilt or relocated sewer line will be constructed as a separated, rather than combined system.

The project area is served by the MDC water supply system for low (domestic) service, high (fire/building sprinkler) service, and high pressure (street hydrant) service. Increased water demand to be generated by the project has been estimated at 58,800 gpd. No significant problems are known to affect the provision of water services to the project area.

Domestic water service lines in Doane Street, to be discontinued with the street's closing, will be replaced by service from State Street. High pressure service lines in Doane Street will be replaced by new lines in Broad Street and in Kilby Street.

HISTORIC RESOURCES

The project is located adjacent to the Custom House National Register Historic District, with one project-related parcel included within the District's boundaries. The Boston Landmarks Commission has rated all structures within the boundaries of the project-site as Type V, "Minor Significance." This category indicates properties which have little individual historical or architectural significance, are substantially altered, or make a minor contribution to the overall streetscape. The immediate surroundings of the project include nineteenth and twentieth century commercial structures to the south fronting on Liberty Square, to the east facing Broad Street, and on the north side of State Street.

The scale and massing of the project has been designed to respond sympathetically to the project's historic context. This includes the use of a low-rise base element fronting on State Street and Kilby Street. The project will result in the creation of a new vista of

the historic Custom House seen from the intersection of State and Congress Street. In order to preserve the character of the project area, the proponent has secured height and mass restrictions on most of the remaining properties which make up the block bounded by State, Kilby, Water and Broad Streets.

WIND

Hot-wire tests, conducted at the MIT Wright Brothers Memorial Wind Tunnel, were used to investigate pedestrian-level wind conditions at 16 specific locations in and around the project site. Preliminary evaluation of the wind tunnel test results suggests that project development under any of the alternative development scenarios will not cause pedestrian-level wind conditions to exceed wind guidelines established by the BRA.

SHADOW

A series of computer-generated shadow analyses have been performed for the 99 State Street Project to predict and evaluate the extent of new project-generated shadows.

Shadow analysis indicates that, for the most part, the development alternatives result in no significant additional shadow in the vicinity of the project. During limited periods at various points in the project area, all three development alternatives were found to add only extremely small areas of increased shadow. This minimal impact is due, in part, to the removal of the 184-foot 89 State Street building, and the set-back position of the project's tower element.

Shadow analysis of the "Jugglers Area" indicates that during late Fall (and early Spring) some incremental shadow effects occur for a very limited period during morning hours as a result of the project. Little difference occurs between the effect of Alternative 2 and Alternative 3 in this area. No new shadows are created in this area by any of the development alternatives during lunchtime peak use periods.

DAYLIGHT

In order to evaluate the development alternatives for the 99 State Street Project in terms of their relative effects on the obstruction of daylight, a system was utilized to calculate the amount of otherwise visible sky which the proposed development would occupy. This calculation was made for four different vantage points surrounding the site.

Seen from the State Street or Kilby Street vantage points, Alternative 1 obstructs a greater percentage of daylight than does either Alternative 2 or Alternative 3. This is due primarily to the fact that Alternative 1 includes a higher base element set close to the street edge, creating a greater effect on daylight obstruction than is created by higher tower elements set back within the block. From these vantage points, the effects of Alternative 2 and Alternative 3 are roughly equivalent. Viewed from State Street, Alternatives 2 and 3 represent little or no change over existing conditions.

As seen from Broad Street or Water Street, none of the development alternatives cause any significant change in daylight obstruction over existing conditions. This is due primarily to the fact that the project site is set back within the block.

CONSTRUCTION

A braced or tied-back concrete diaphragm wall constructed by the slurry trench method is planned to be utilized in construction of the project's foundation. This method will provide greater stiffness than would systems such as soldier piles or sheet piling, allowing only a small magnitude of ground movement and mitigating any need to underpin adjacent structures. The use of a concrete diaphragm foundation wall will provide a cut-off barrier to horizontal water seepage, thus hydraulically isolating the excavation and minimizing any potential impact on the area's water table. This method also minimizes the noise and vibration which would otherwise be associated with foundations using soldier piles or sheet piles.

Because the Kilby Street Parking Garage will be closed during the construction period, a substantial generator of area traffic will be eliminated. As a result, the addition of truck traffic during constructon is not

expected to increase area congestion or decrease the level of service of area intersections beyond current levels, and is not expected to adversely affect ambient air quality as compared with existing conditions.

A full listing of planned mitigation measures to minimize construction-related effects associates with foundation conditions, groundwater, traffic, noise and air quality are listed in Section IV-G.

II Project and Area Description

PROJECT DESCRIPTION

The 99 State Street/Kilby Street Garage Project will result in the creation of a 700,000 square foot office building on State Street in Boston's financial district. The project, which will include a 15,000 square foot ground-floor retail component, has been designed to be compatible with the scale and character of development in the surrounding area. The program of planned office and commercial uses has been developed to reflect the overall character of land uses in this area of the city. The project is currently in the concept-design stage of development.

The project's massing will be comprised of a low-rise base element fronting all edges of the site, and a stepped tower element set back from street frontage. The configuration of these elements has been designed to complement the scale and massing of neighboring structures, and to avoid or minimize the creation of wind or shadow effects, or the obstruction of daylight, in the vicinity of the project. Comparing the current 700,000 square foot building program with the project's 59,861 square foot site results in a floor area ratio (FAR) of 11.69, well below the BRA's requirement for a maximum 12.25 FAR for this site.

Pedestrian connections established by the project will reflect the area's history of through-block pedestrian walkways. These will include a ground-level retail arcade oriented to Merchants Row, an important pedestrian link between the financial district and Quincy Market (see Exhibit II-3). The project will also establish a pedestrian link between Kilby and Broad Street via a walkway aligned with Central Street and Exchange Place. Streetscape improvements will be provided in the vicinity of the site, and will be planned in conjunction with the BRA.

Up to 700 on-site parking spaces below grade are currently planned for the development. Garage access/egress will be from Broad Street via a depressed ramp on a portion of what is now Doane Street, which will be closed. By relocating the existing Kilby Street garage entrance/exit to this point, traffic will be removed from the area's most congested intersections. The new garage will also result in shorter queuing periods for vehicles waiting to park on-site. Loading and receiving will occur at-grade within Kilby Place, located away from vehicular and pedestrian traffic utilizing surrounding streets.

The project's exterior will consist of a masonry facade compatible with the materials and fenestration of older commercial structures in the surrounding area. This will include the extensive use of granite as an exterior material, special attention to the texture and pattern of the building facade and fenestration to create interest and maintain compatibility with area buildings. Of particular interest in the design approach will be a low-rise base element with frontage on State Street and Kilby Street, where variety in facade articulation and a careful use of masonry materials can contribute greatly to an improved pedestrian experience.

In addition to establishing an attractive new building in Boston's financial district, the project will enhance the visual quality of the area in a number of other ways. These include the elimination of an unattractive garage structure, the elimination of a vacant lot on a prime downtown corner, the creation of coherent commercial street frontage, and the creation of a new vista of the historic Custom House Tower seen from State and Congress Streets.

The 99 State Street Project has been designed in response to guidelines prepared by the BRA and Boston Society of Architects (BSA) specifically for development of this site. Refinement of this design is continuing in consultation with the BRA and BSA as part of an ongoing design review process.

PROJECT SITE

The 99 State Street site consists of approximately 1.37 acres in Boston's financial district within an area fronting on State Street to the north and Kilby Street to the west (see Exhibit II-2). The site is bounded to the south by Kilby Place, a dead-end alleyway which runs behind buildings fronting on Water Street, and is used for access to the Kilby Street Parking Garage. The site's eastern boundary follows property lines located on the interior of the block, and does not consist of any frontage on Broad Street.

Land uses currently existing on-site consist primarily of office buildings and ground-floor retail facilities. The total of office and retail uses on-site is approximately 140,000 square feet. The project site is

completely developed, with the exception of a vacant parcel at the corner of Kilby Street and State Street. The vacant parcel is currently used as a parking lot and as the location of a photographic-processing kiosk.

Doane Street runs in an east/west direction through the site between Kilby Street and Broad Street. Doane Street is a narrow alley utilized primarily as a rear delivery area for buildings fronting State Street. Fire escapes, ventilation ducts and mechanical equipment are characteristic of building exteriors along Doane Street.

Located on Kilby Street, between Doane Street and Kilby Place, is the ten-story Kilby Street Mechanical Parking Garage, the original property targeted for redevelopment by the BRA within the project area. The Garage consists of approximately 700 spaces which are accessed via an elevator system. Exterior materials of the Garage consist of light yellow brick and multi-colored panels uncharacteristic of development in the surrounding area.

Located within the site at #89 State Street, directly across from Merchants Row, is the Fiske Building. Originally a granite-faced Romanesque office structure, the Fiske Building was inappropriately altered in 1964 when the decorative tower and facade cornices were destroyed, and a blue aluminum and glass curtain wall was installed. At sixteen stories, the building is highly visible from views along State Street, and is inconsistent in terms of style and materials with buildings in the area.

Other buildings on-site include two older five-story commercial buildings standing on either side of the Fiske Building, a larger seven-story brick commercial building at #5 Doane Street, and a nine-story granite faced building at #20 Kilby Street.

AREA DESCRIPTION

The 99 State Street Project is located within an area at the northern edge of the city's financial district, just south of Quincy Market. The character of structures in the vicinity of the project site reflect the area's origins as a turn-of-the-century commercial center, as well as its subsequent development as the

home of a variety of major real estate, banking and other financial institutions.

The site is located in an area of high-rise structures averaging 40 stories and exceeding 400 feet in height. These include Exchange Place, 60 State Street, and One Post Office Square, as well as the Custom House Tower. Building heights of older structures to the south and east of the project are generally in the range of 75 to 150 feet. Development in the area ranges from modern high-rise structures to a variety of older architectural styles including Romanesque, Beaux Arts, Federal and Classical Revival. Building materials consist primarily of brick and granite, with structures set uniformly at the street line.

The project area is the site of considerable pedestrian activity during working and commuting hours. A principal focus of pedestrian activity in the vicinity of the project is Quincy Market, where a wide variety of restaurants and shops cater to the area's large employee population, as well as to a significant number of tourists. Quincy Market is linked to State Street by Merchants Row, located directly across State Street from the project site. Merchants Row is a small paved roadway leading directly into the brick-paved pedestrian plaza surrounding Quincy Market, and lined with retail establishments along both sides.

To the west of the site is another center of pedestrian and vehicular activity at the intersection of State Street and Congress Street. This intersection, located opposite the historic Old State House is the site of heavy pedestrian traffic between the financial district and Quincy Market, as well as to and from various MBTA transit stations, including the State Street, Government Center and Haymarket Stations.

To the south of the project is Liberty Square, located at the intersection of Kilby Street, Water Street, Batterymarch Street and Oliver Street. The Square currently centers on a large expanse of open pavement. A landscaped traffic island, financed by neighboring businesses, is planned for construction in Liberty Square during the summer of 1985.

Central Court, also known as Hamilton Park, is located adjacent to the site, at the western terminus of Central Street. The area consists of a small landscaped courtyard, with entrances to neighboring buildings on each side.

Roadways

State Street is a major one-way connector roadway traveling westbound, linking Atlantic Avenue and the Waterfront area to Congress Street, the financial district and Government Center. Loading and delivery activity occurs on State Street in the project vicinity.

Kilby Street is a one-way local street paralleling Broad Street, and linking Liberty Square to State Street. On-street parking is prohibited.

Broad Street is a wider two-way roadway travelling north-south through the financial district. Broad Street acts as the major internal circulation roadway within the financial district, providing access to a number of smaller, one-way streets. Metered parking is available on both sides of Broad Street.

Doane Street is a narrow one-way roadway linking Kilby Street to Broad Street, and is used as a circulation route for vehicles searching for on-street parking spaces on Broad Street and for trucks loading and unloading supplies to abutting buildings.

Exhibit II-1

LOCUS MAP
99 State Street/Kilby Street Garage Project
Boston, Massachusetts

Scale 1:25,000

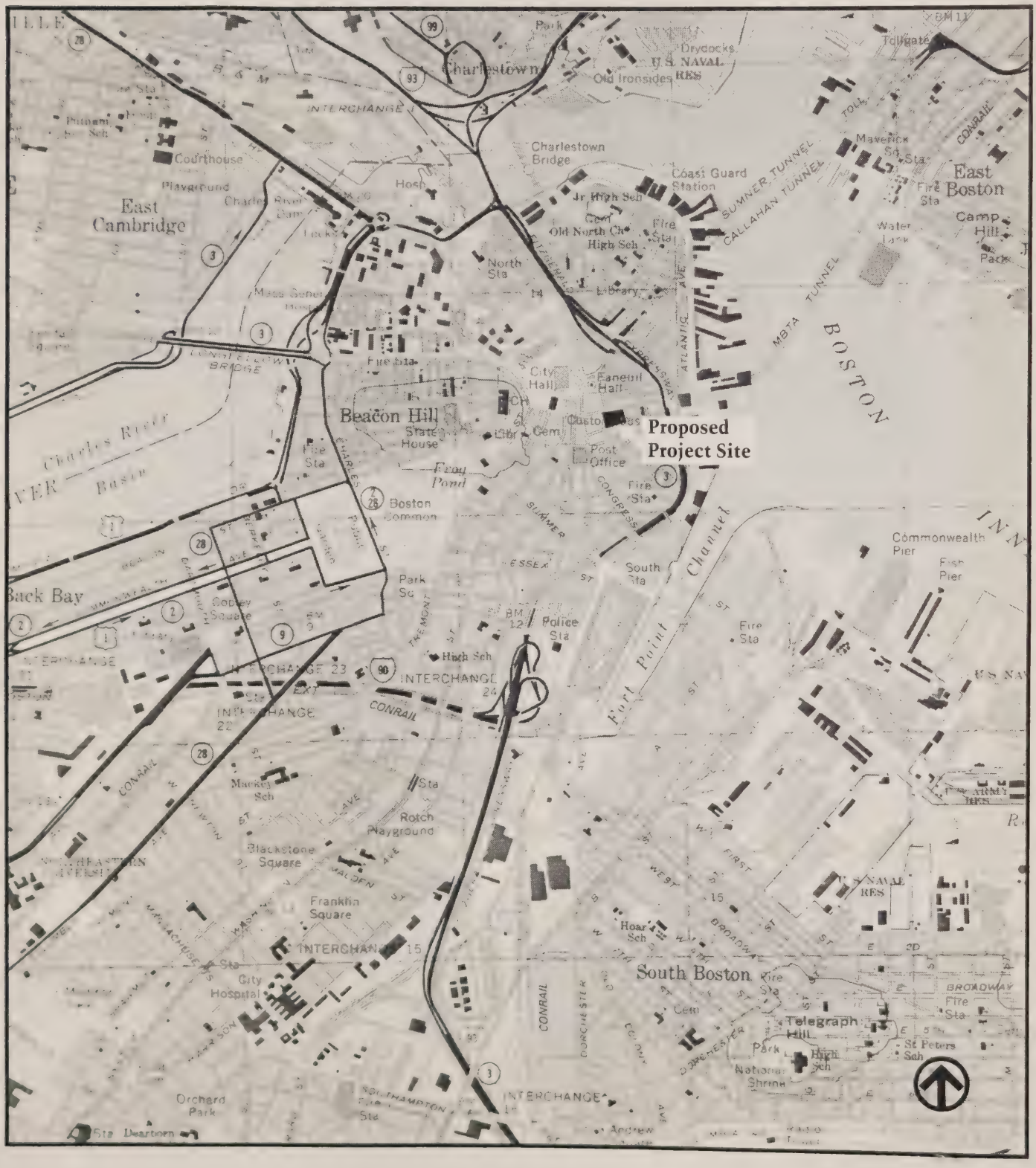
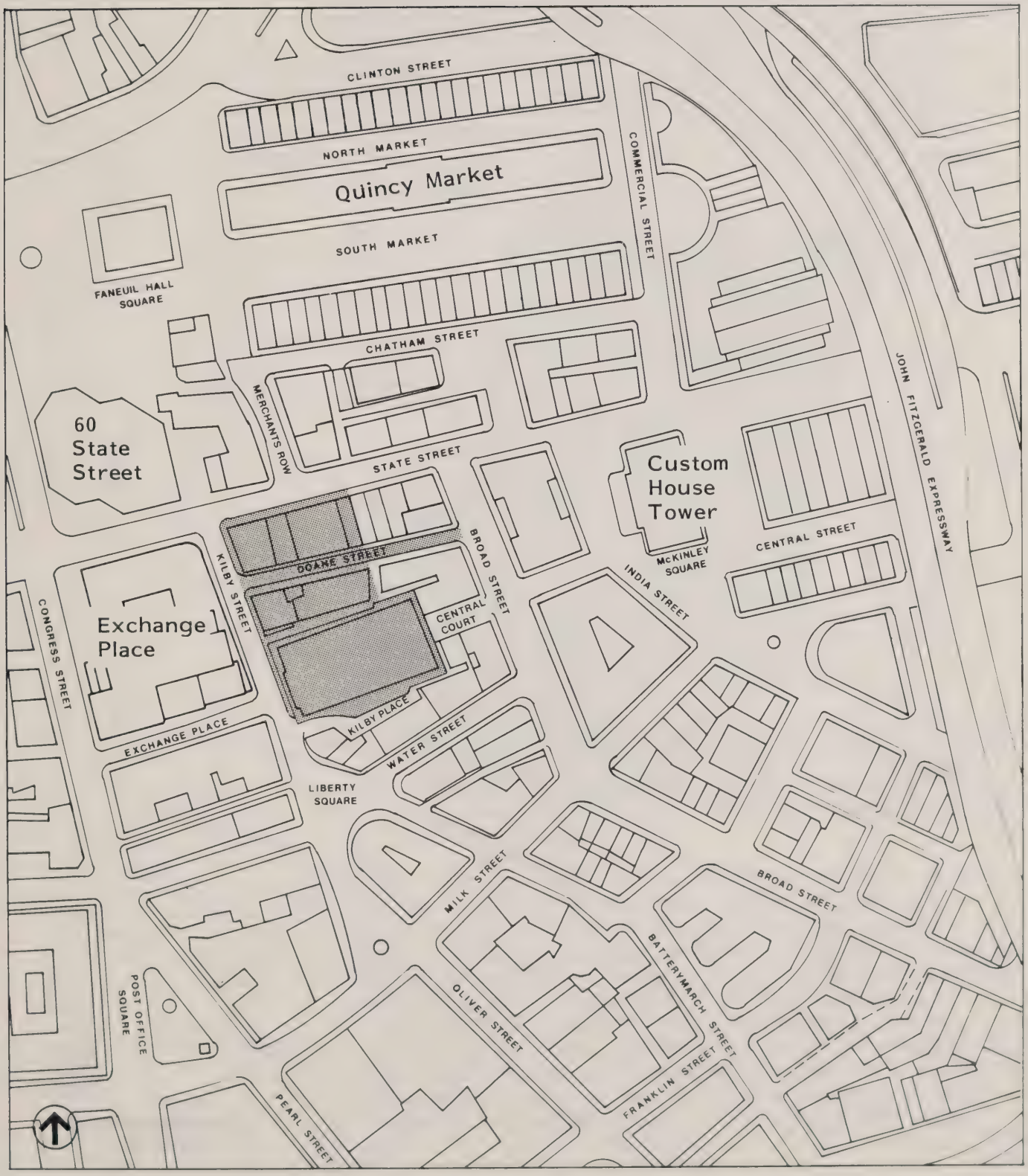


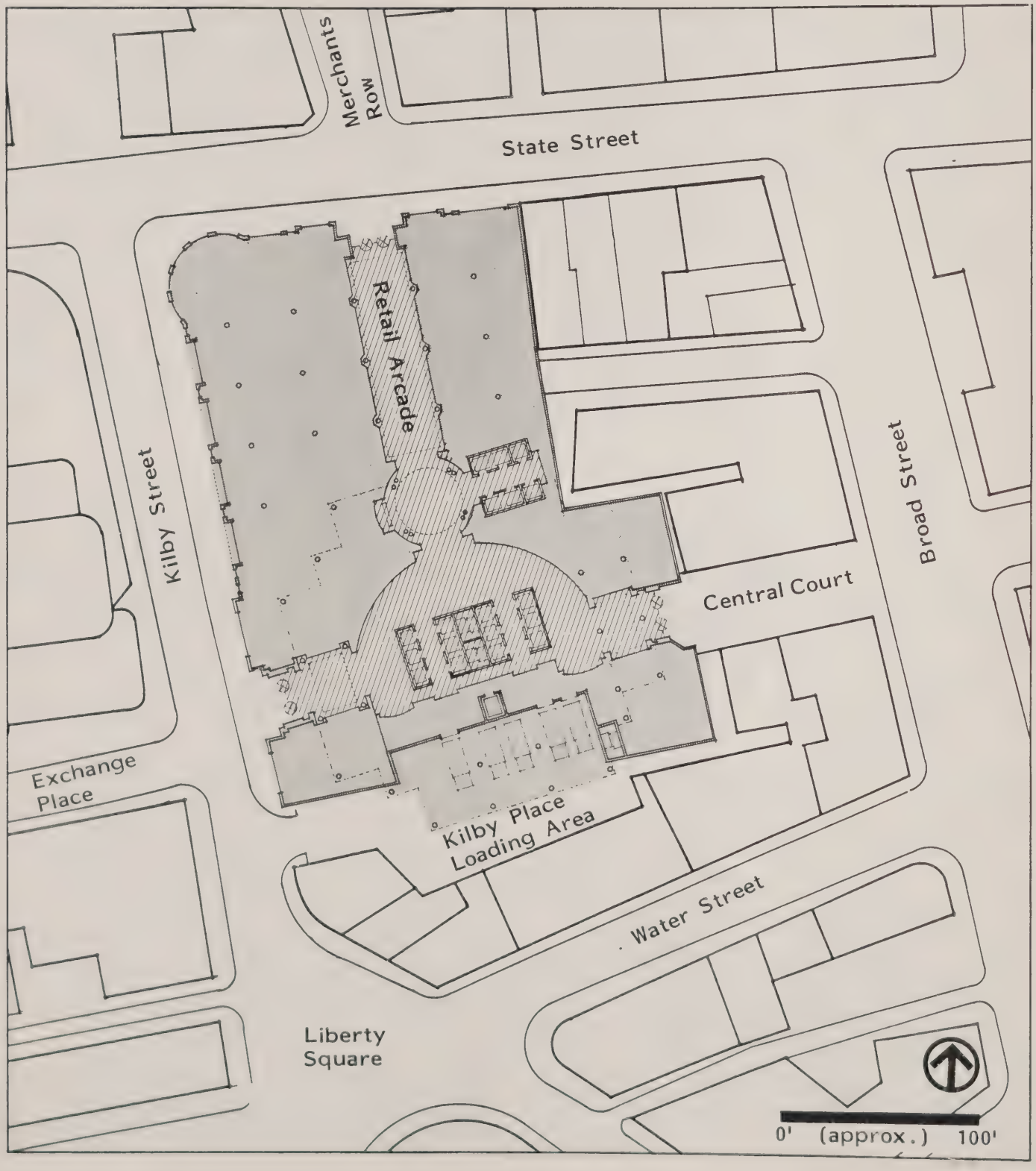
Exhibit II-2

SITE VICINITY MAP



1"=200'

Exhibit II-3 GROUND FLOOR PLAN



III Description of Alternatives

DESIGN PROCESS

The Alternatives selected for analysis in this document have been developed as part of an ongoing design review process conducted in conjunction with the BRA and initiated in 1982, when the Kilby Street Garage parcel was advertised by the BRA for development interest. As a result of this solicitation, the Authority received five preliminary development proposals. In December 1983, the City issued Tentative Designation to the 99 State Street Joint Venture as redevelopers of the Kilby Street garage facility and the adjacent discontinued portions of Doane Street. The 99 State Street Joint Venture had also acquired rights to 89 State Street and 5 Doane Street by that time, producing a development site of approximately 44,460 square feet.

In April 1985, the Tentative Designation was revised and reaffirmed by the BRA based upon the following modifications:

- The addition of The Beacon Companies as a member of the development team resulted in its reconstitution as the 99 State Street Limited Partnership, hereafter referred to as the proponent.

- Responding to direction from the City to expand the development parcel, the proponent acquired rights to several adjacent parcels, including 75 State Street, 85 State Street, and 20 Kilby Street. The development site established as a result of these acquisitions totals 59,861 square feet.

- In order to preserve the character of the vicinity of the site, the proponent secured height and mass restrictions on most of the remaining properties which make up the block bounded by State, Kilby, Water and Broad Streets.

These changes led to revision of the project's development program and design. The acquisition of additional parcels made it possible to increase the allowable square footage of the project from a previous figure of 550,000 square feet to a gross floor area allowance of 700,000 square feet. The FAR of 10 was applied to these additional acquisitions, which total 15,000 square feet of land. Programmatic changes included additional on-site parking not to exceed 700 spaces, and a reduction in retail space from a previous figure of 50,000 square feet to approximately 15,000 square feet.

In order to fulfill requirements of the BRA design review process for this project, this Draft Environmental Assessment has been prepared. For analysis and comparison in this document, three project alternatives have been selected in consultation with BRA staff.

Each alternative is comprised of 685,000 square feet of office space and 15,000 square feet of retail space. The ground floor configuration of each alternative is identical, each including a retail arcade aligned with Merchants Row and an interior walkway connecting Kilby Street and Broad Street. The principal differences between these alternatives is the configuration of the base and tower elements, as described in the following section.

Because the development alternatives differ on the basis of building massing rather than in development program, impact analysis for programmatic issues will address only the build and no-build alternatives. Such topics include traffic, water, sewer and construction impacts. Issues related to building massing will be assessed for each alternative. These topics include historic resources, wind, shadow and daylight.

The no-build alternative is included in this analysis in order to compare the effects of each of these development alternatives with the effects of maintaining existing conditions on-site.

ALTERNATIVES

Alternative 1

Of the three building massing alternatives being addressed in this document, Alternative 1 places the largest proportion of building program within its base element, which rises to nine stories, or 116 feet in height. This massive base element is necessitated by establishment of a relatively low maximum total height for this alternative. The tower element of Alternative 1 is the lowest and broadest of the three building massing schemes being considered. At nineteen stories (including base) the tower is 238 feet in height to the parapet (263 feet to mechanical) and extends closer to the State Street property lines than does the tower in Alternative 2 or Alternative 3.

Alternative 2

The base element of Alternative 2 is five stories, or 67 feet, in height, designed to provide a reasonably consistent street wall with remaining structures along State Street and in Liberty Square. As a result of this lower base, more building program is placed within the tower element of the structure. In this Alternative, the tower is 370 feet in height to the parapet (395 feet to mechanical) including base. The 30-story tower is set well-back from State Street in a position generally aligned with Central court, and provides a more generous upper level setback along Kilby Street.

Alternative 3

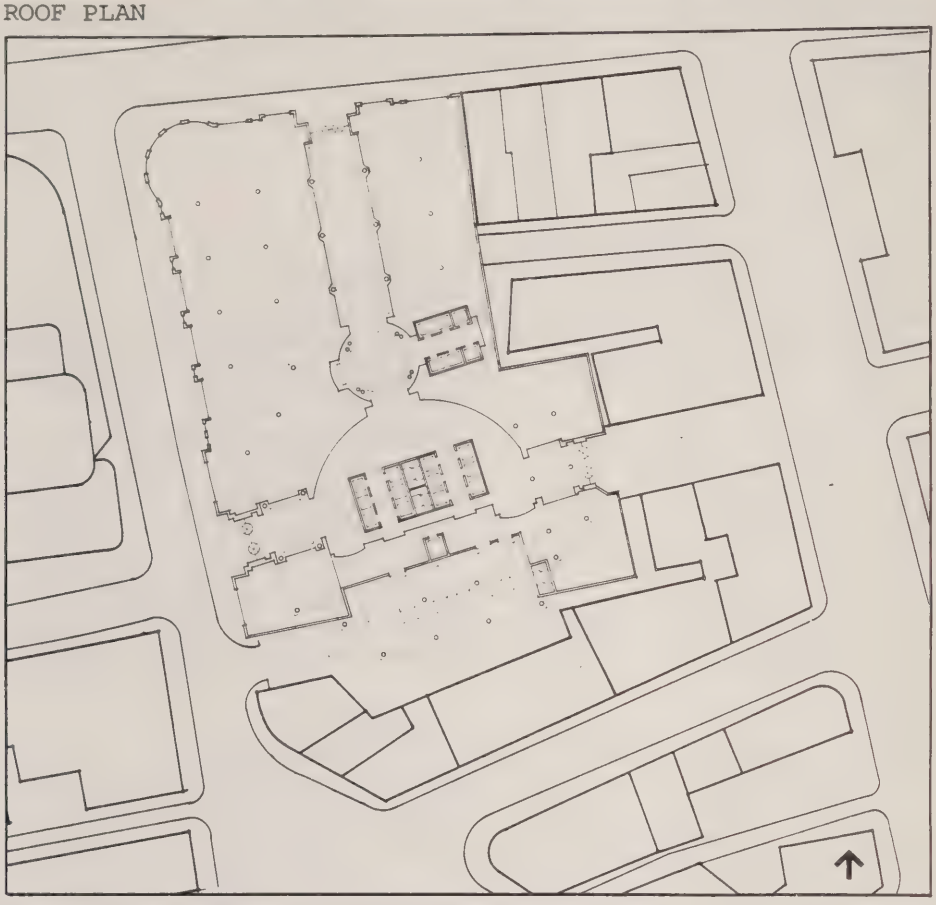
Alternative 3 has the same five-story base element as Alternative 2, but has a more slender tower rising above the base. In this alternative, the tower height is 410 feet in height to the parapet (435 feet to mechanical) including base, a total of 33 stories. As in Alternative 2, the tower is set well-back from State Street. However, in this case the tower is also set further in from Kilby Street than in either Alternative 1 or Alternative 2.

No-Build Alternative

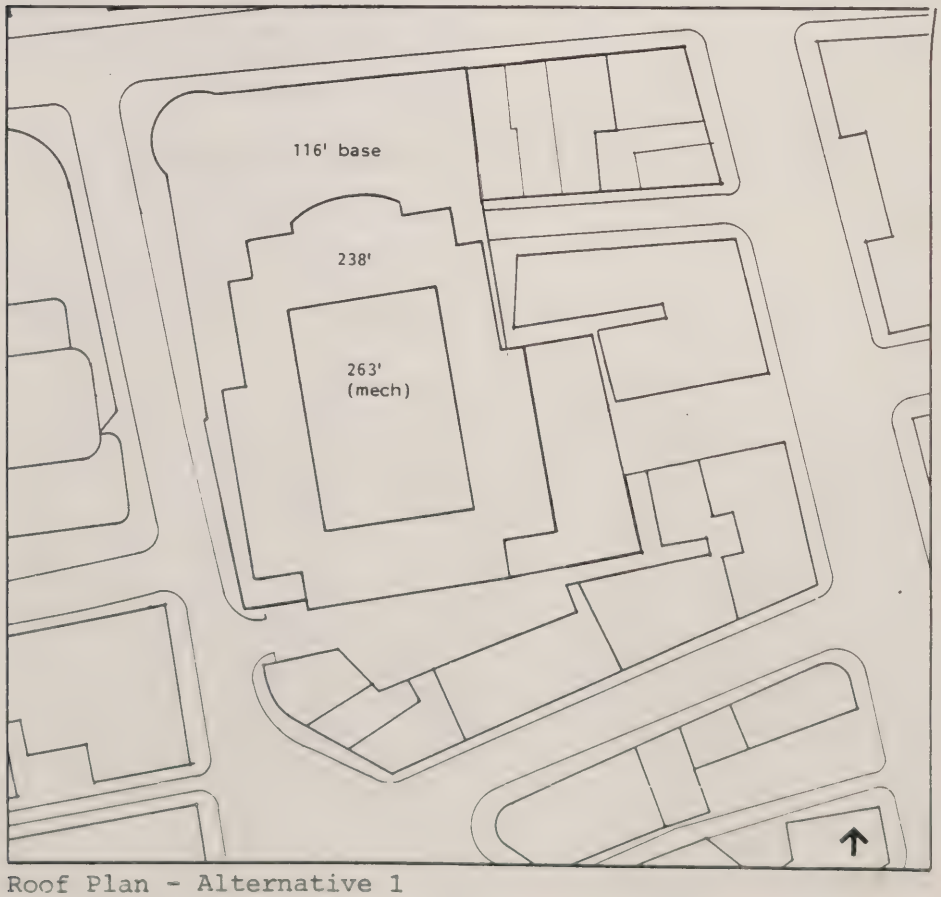
This scenario assumes that existing conditions on-site will be maintained, and that no redevelopment activity will occur. Existing conditions are described in Chapter II -- Project and Area Description.

Exhibit III-1

ROOF PLAN



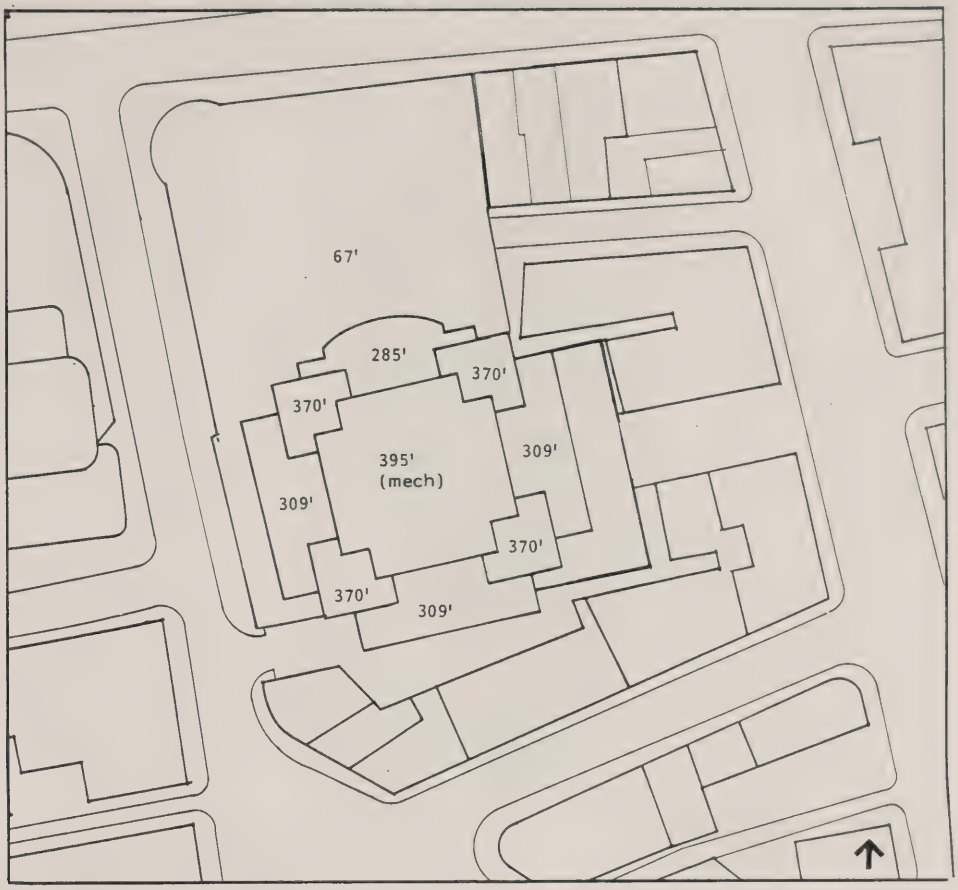
Ground Floor Plan - All Alternatives



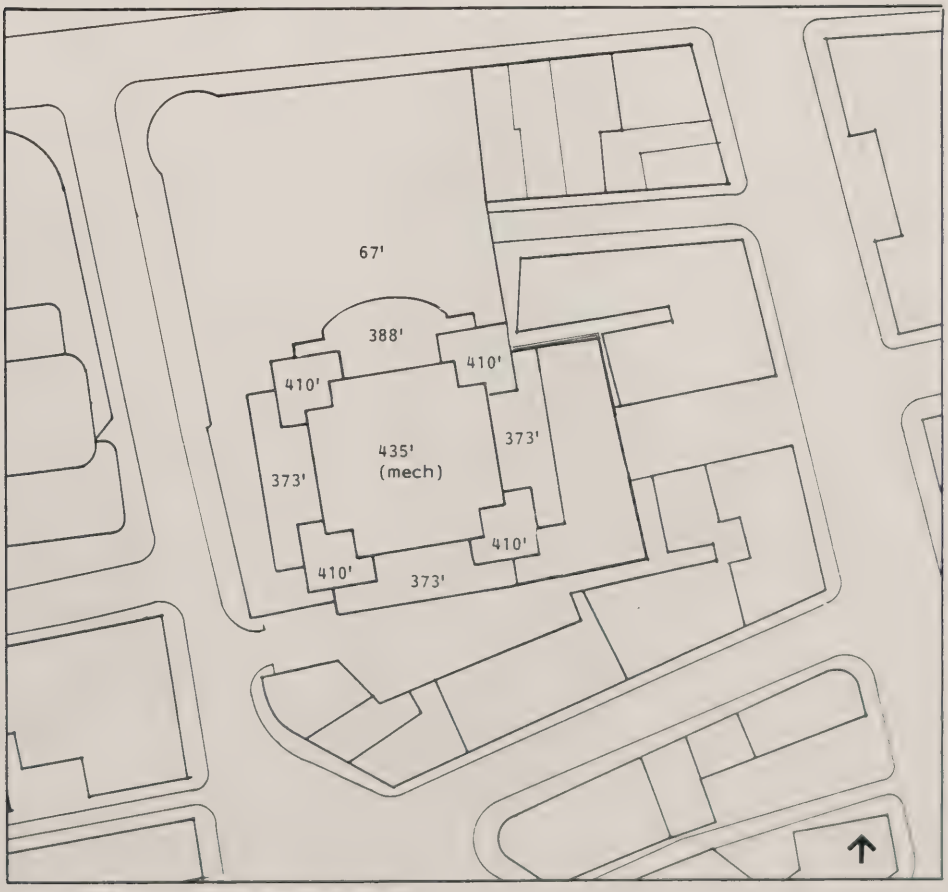
Roof Plan - Alternative 1

Exhibit III-1

ROOF PLAN



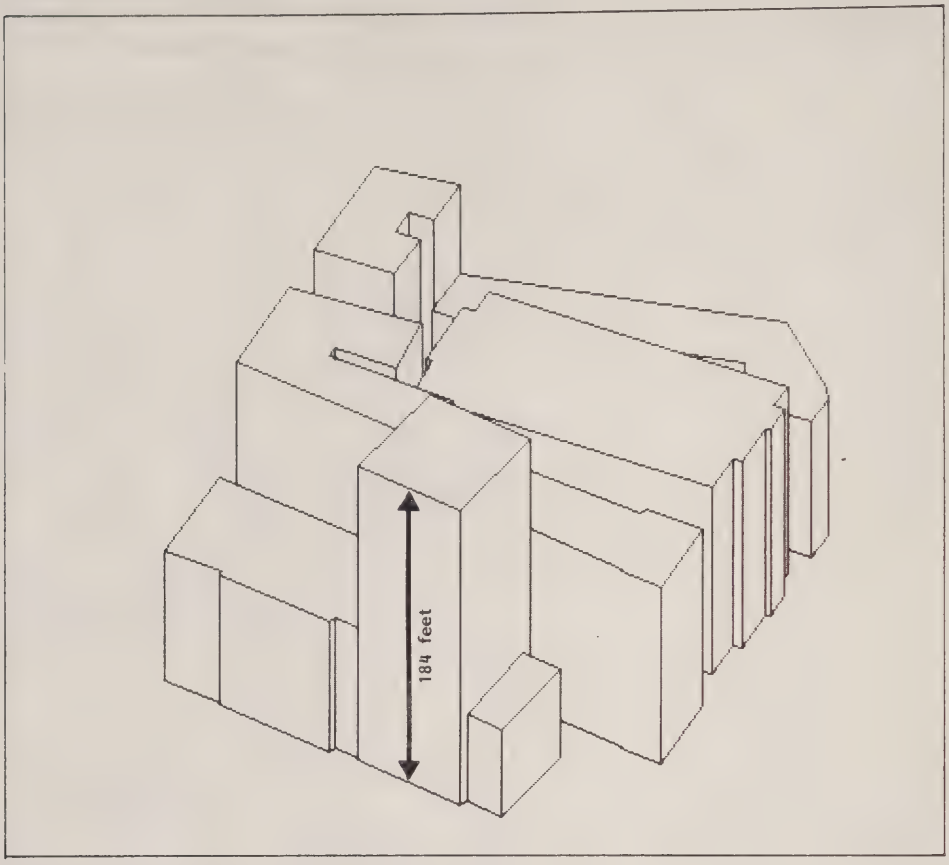
Roof Plan - Alternative 2



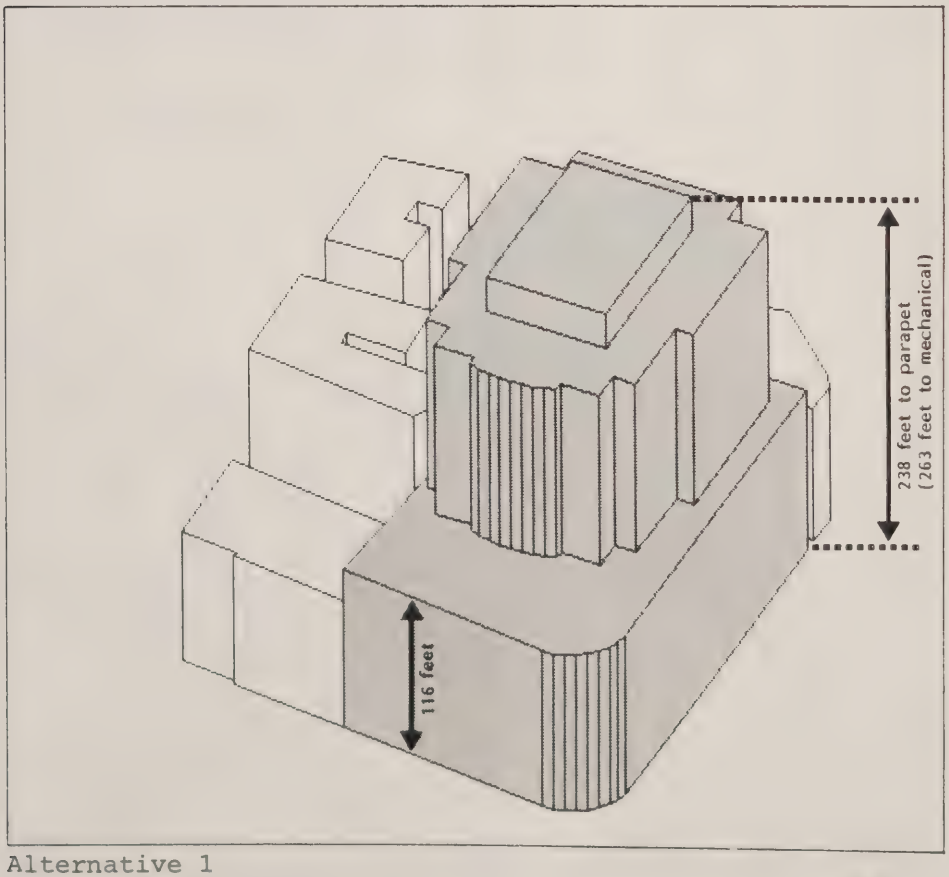
Roof Plan - Alternative 3

Exhibit III-2

PERSPECTIVE VIEW



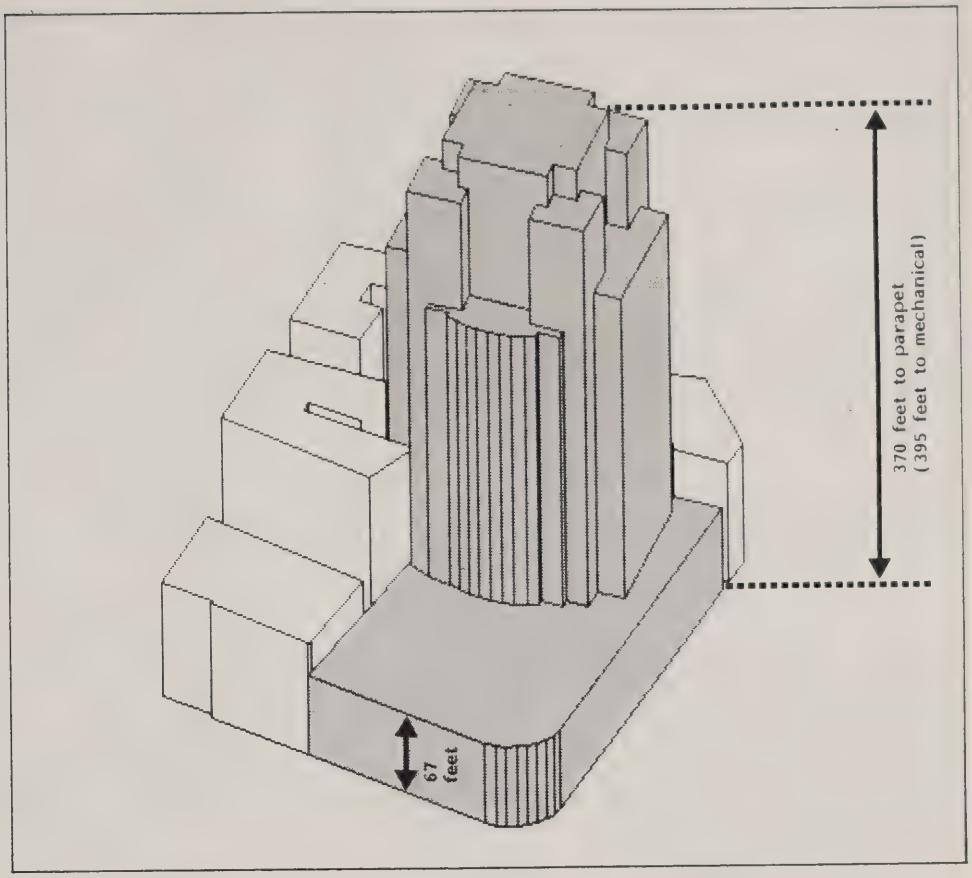
Existing Conditions



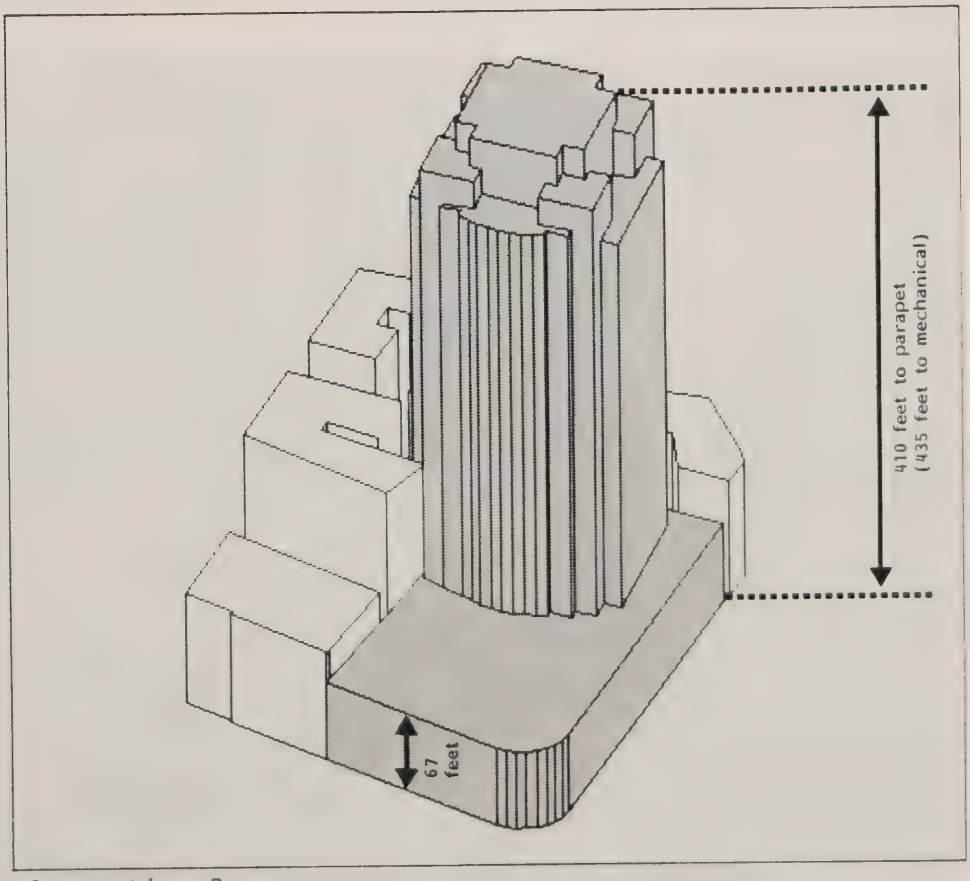
Alternative 1

Exhibit III-2

PERSPECTIVE VIEW

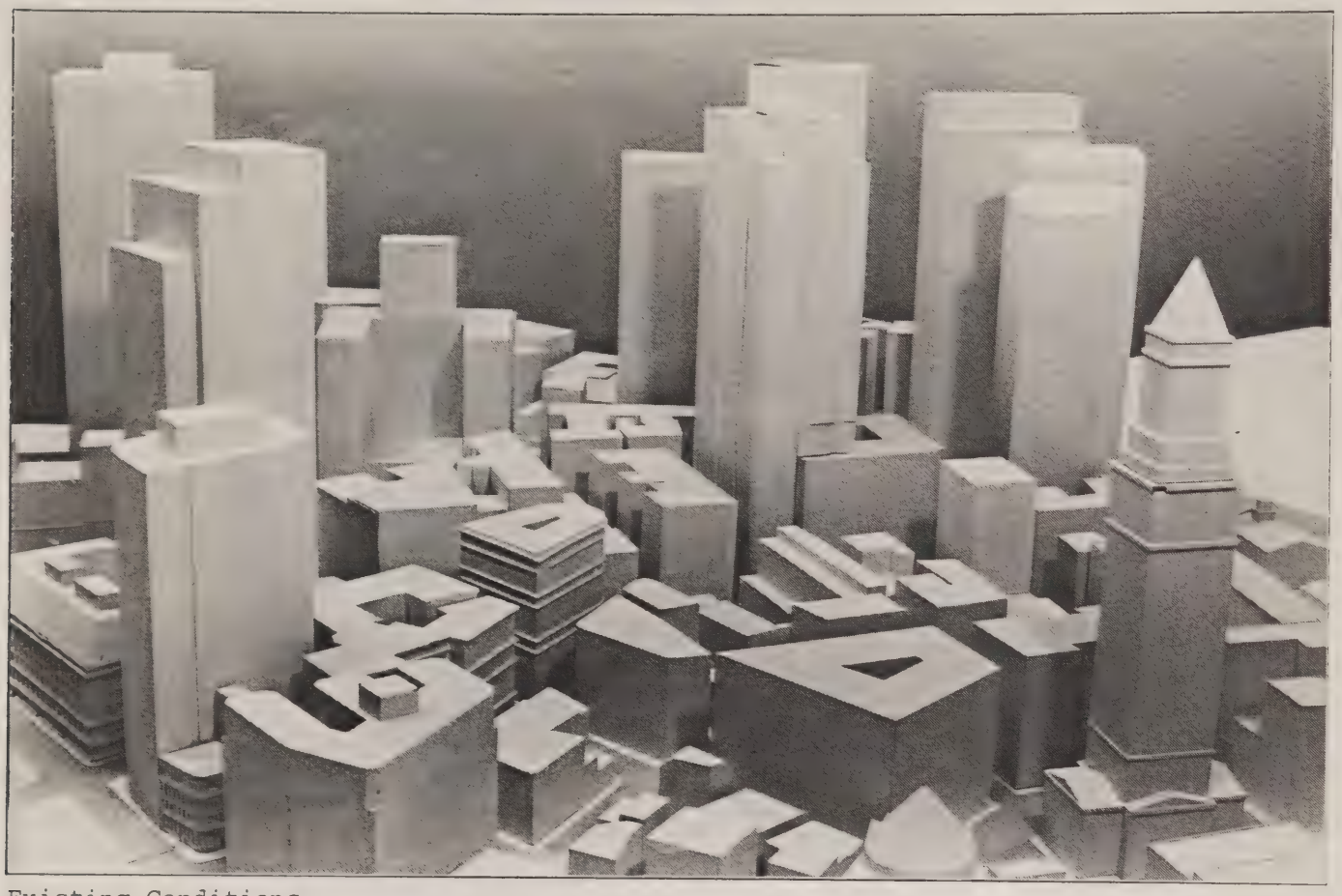


Alternative 2



Alternative 3

Exhibit III-3 MODEL PHOTOGRAPHS



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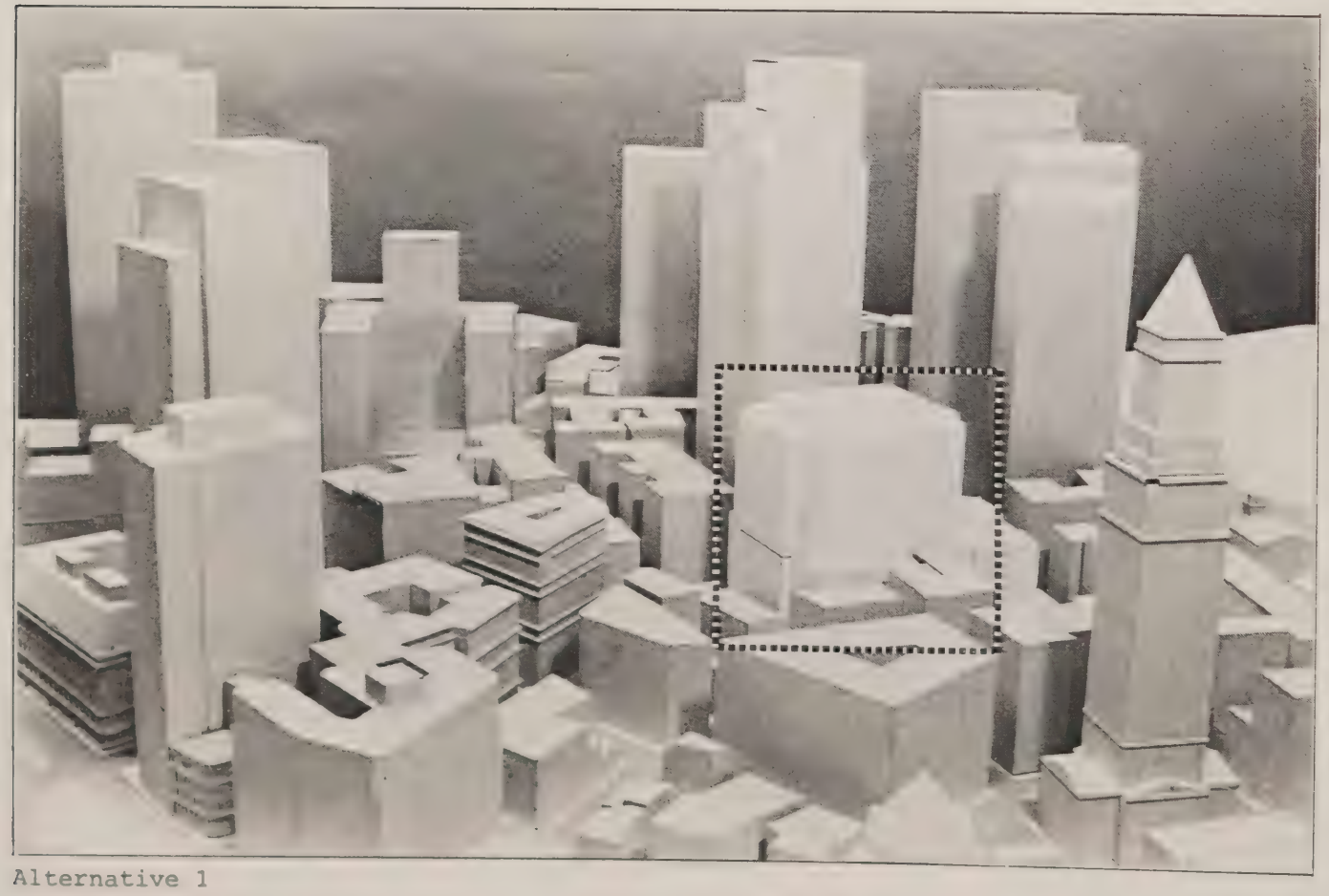
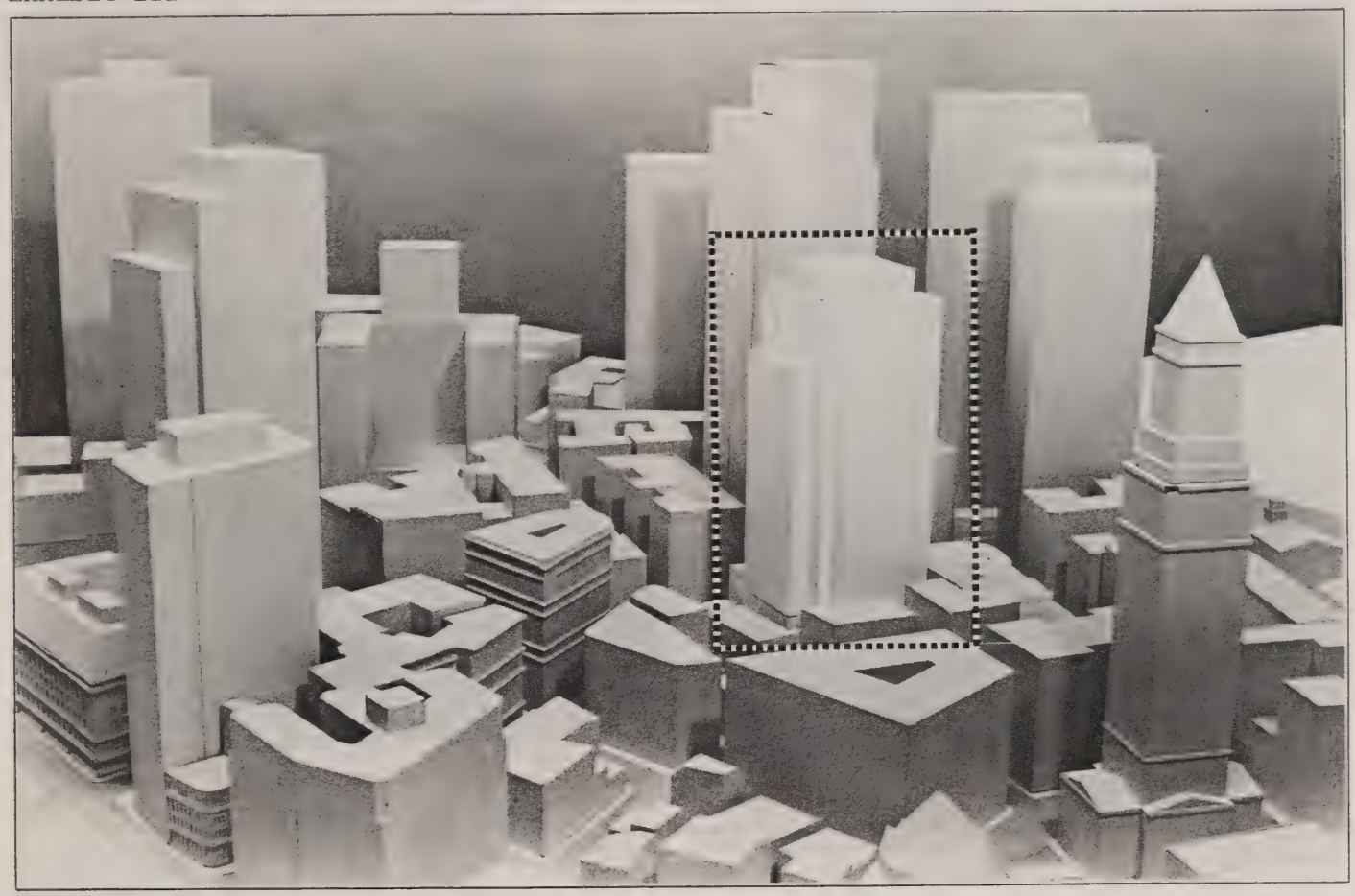
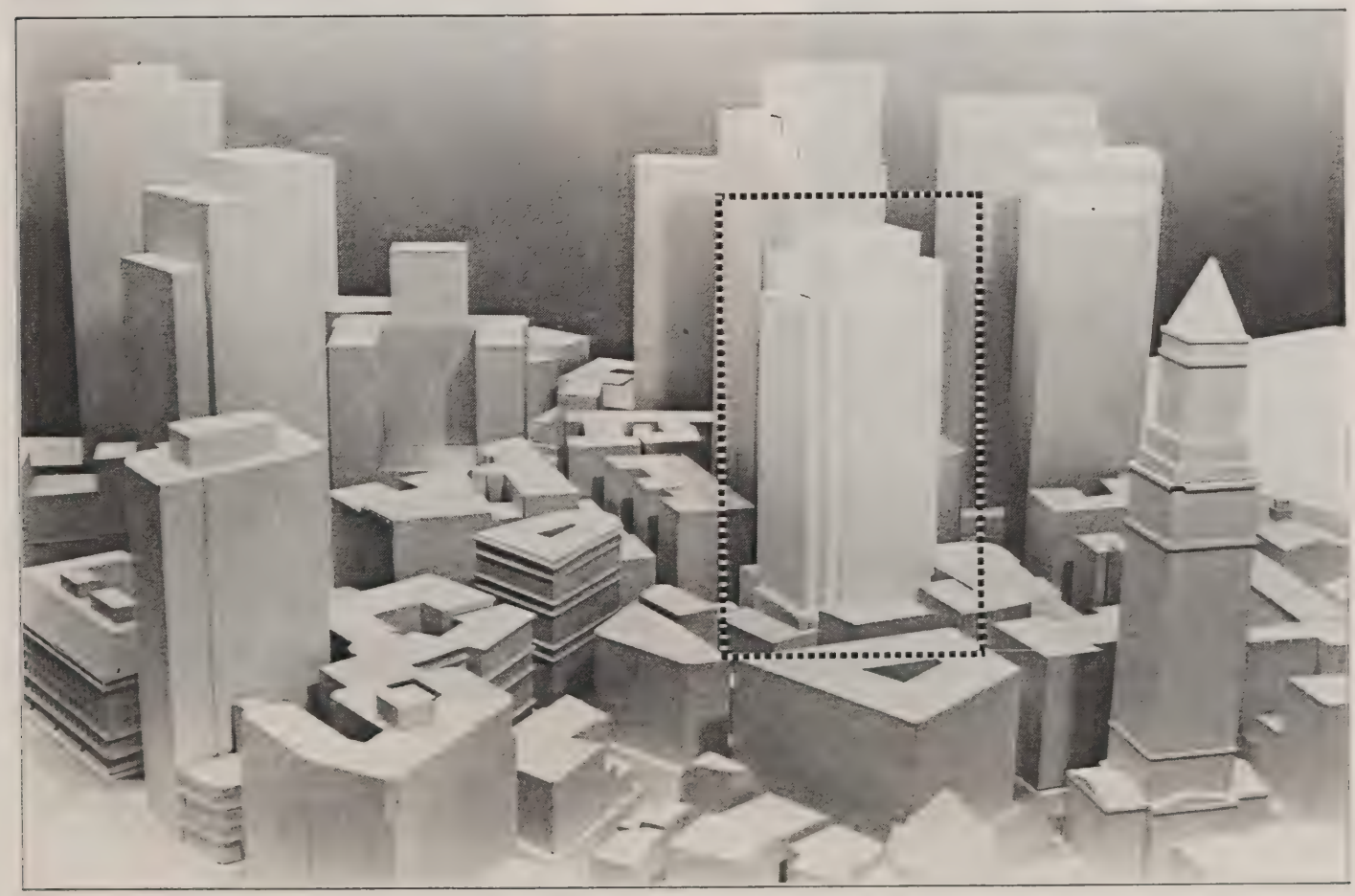


Alternative 1

Exhibit III-3 MODEL PHOTOGRAPHS

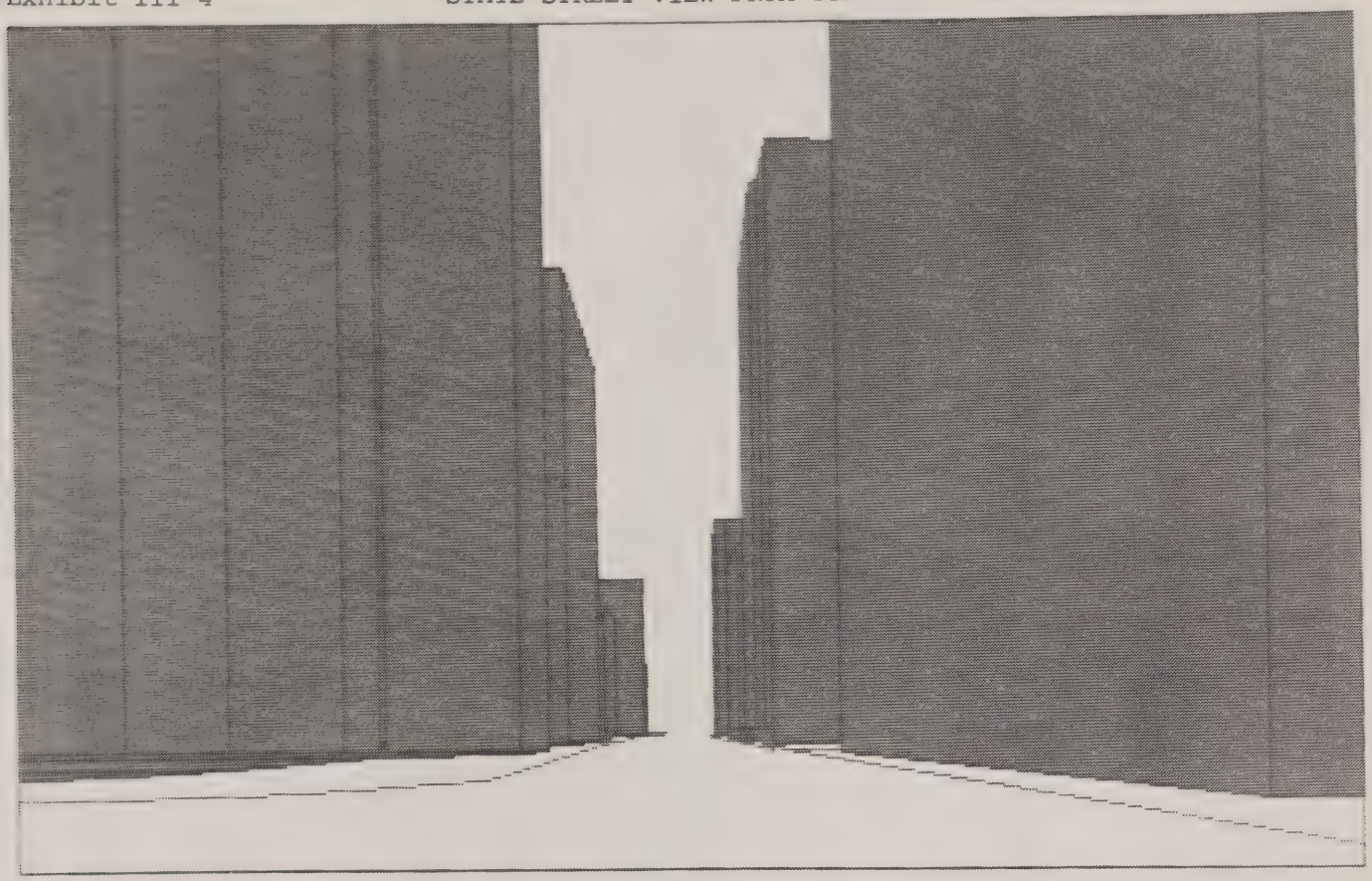


Alternative 2

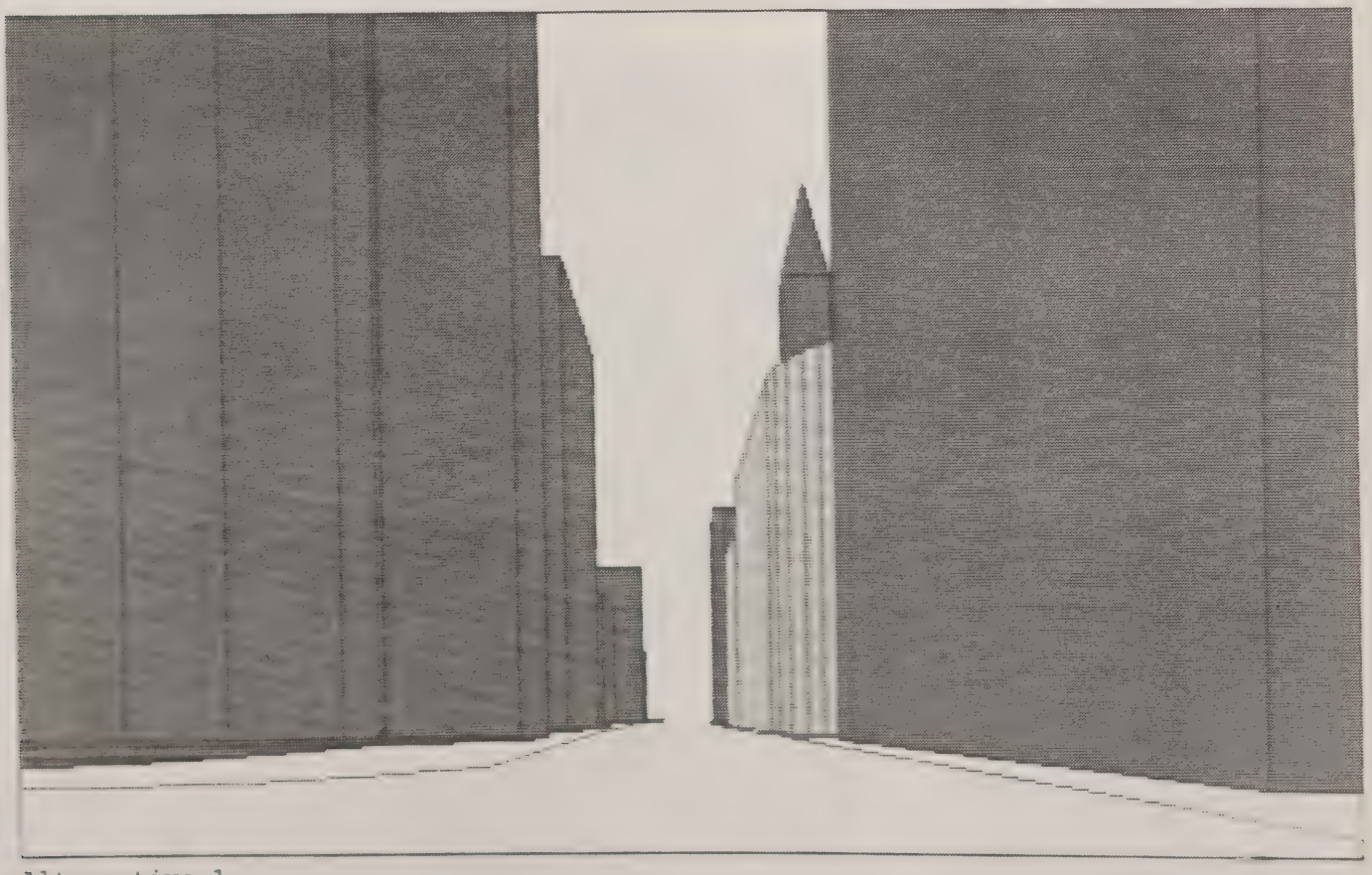


Alternative 3

Exhibit III-4 STATE STREET VIEW FROM CONGRESS STREET

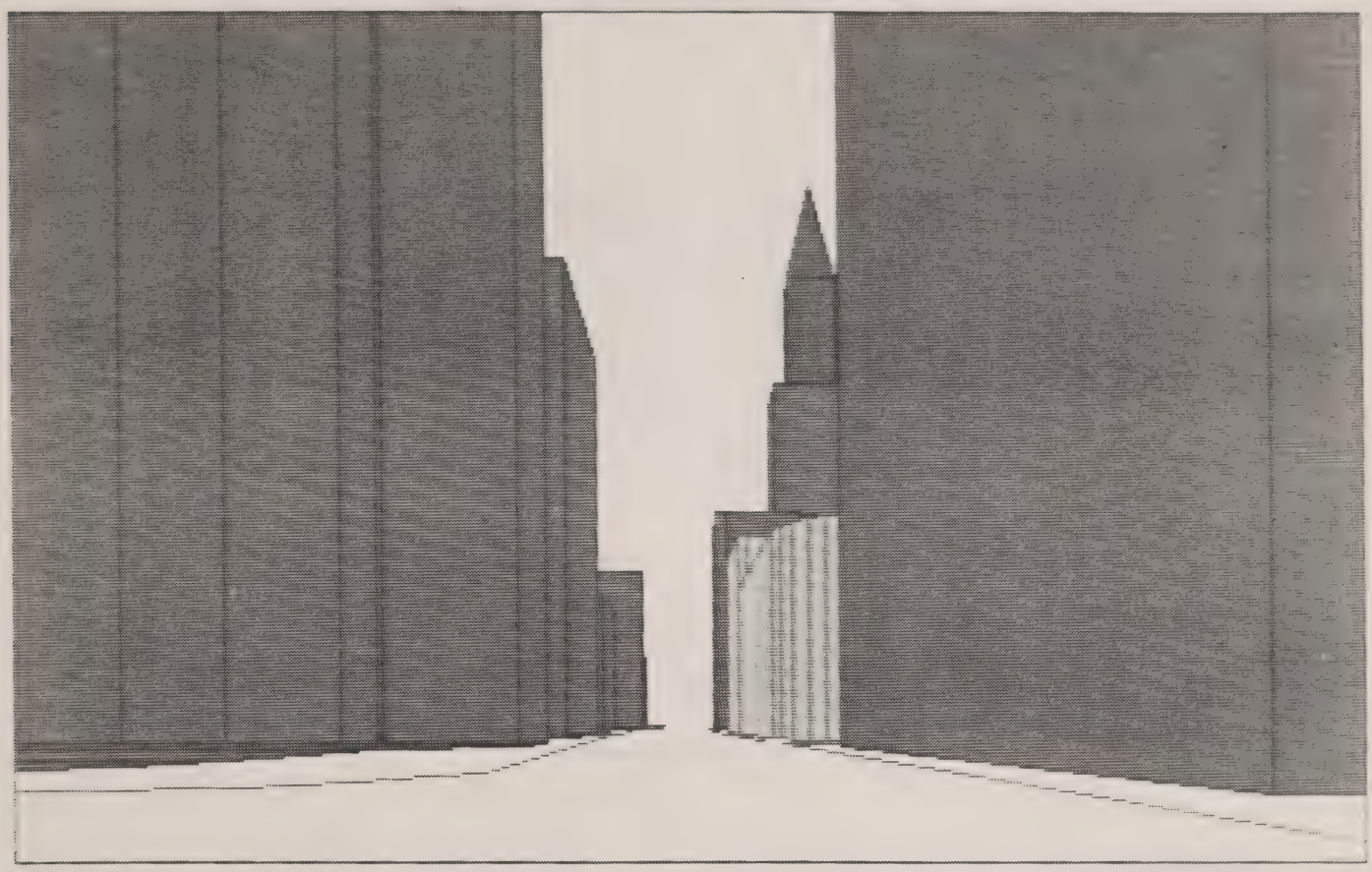


Existing Conditions

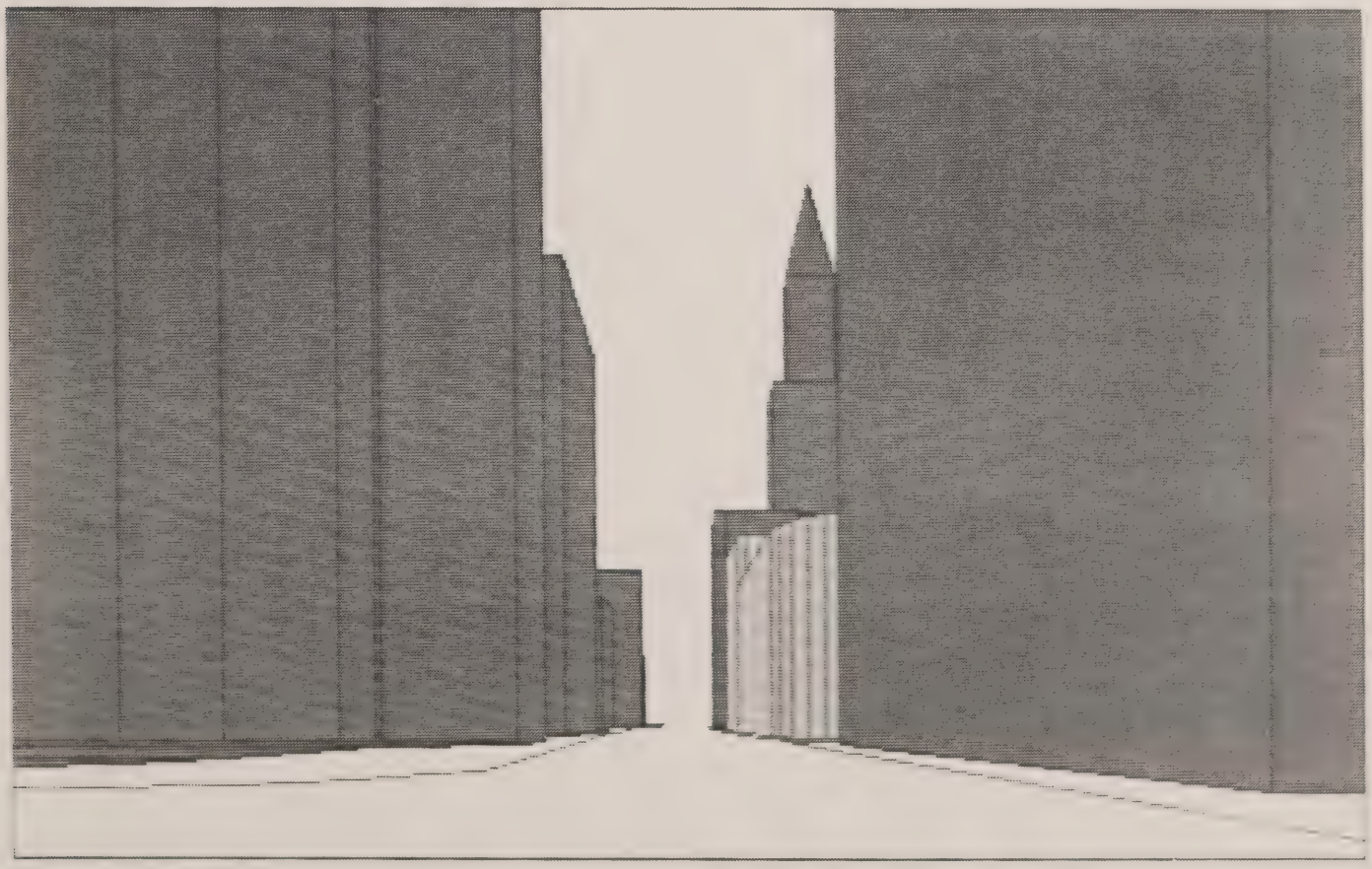


Alternative 1

Exhibit III-4 STATE STREET VIEW FROM CONGRESS STREET



Alternative 2



Alternative 3

IV Environmental

As agreed upon with the BRA, the following environmental issues pertinent to the 99 State Street/Kilby Street Garage Project are discussed in this Chapter:

A. Traffic

B. Water and Sewer Service

C. Wind

D. Shadow

E. Daylight

F. Historic Resources

G. Construction

A Traffic

INTRODUCTION

This section describes existing traffic related conditions in the project's study area, estimates the impact of the development in terms of vehicle and pedestrian trips to the site, and provides a qualitative analysis of the study area under existing and future conditions. As a benchmark, it also provides an analysis of conditions in the design year without development of 99 State Street, but with projects currently under construction and/or approved. Under this latter condition, current trips to the office and retail uses and the parking garage are retained.

Based upon this initial review of traffic conditions and discussions with BRA staff, a more detailed quantitative analysis of existing and future conditions is currently underway. Results will be provided as part of the Final BRA Environmental Assessment.

STUDY AREA

The study area defined for this project includes links and major intersections within a perimeter bounded by the Surface Artery to the east, State Street on the north, Congress Street on the west and Milk Street on the south. In addition, three intersections beyond this perimeter have been identified as possible impacted areas. These include:

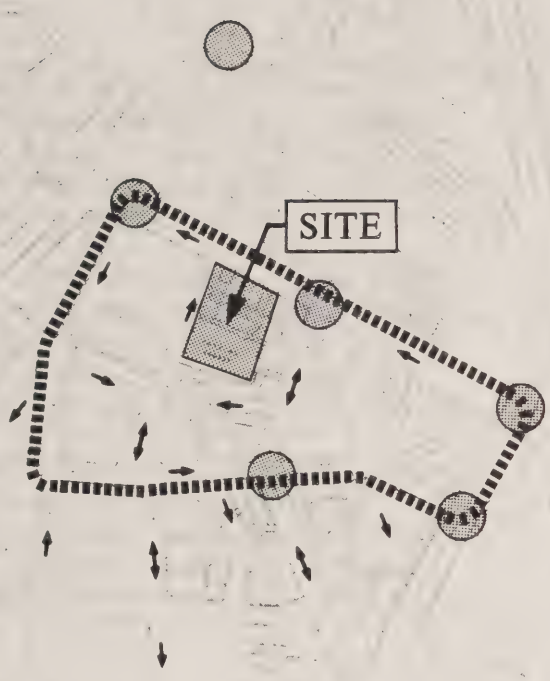
1) Congress Street at North Street
2) Congress Street at Purchase Street
3) Surface Artery/Atlantic Avenue/High Street/Broad Street

The Study Area is illustrated in Exhibit IV A-1.

EXISTING CONDITIONS

99 State Street Parcel

The development site has frontage on both State Street and Kilby Street extending from their intersection to a point approximately 175 feet east of the intersection on State Street and 280 feet south along Kilby Street. The Kilby Street frontage includes a crossing of Doane Street which is the subject of a discontinuance hearing with the City.



LEGEND

STUDY AREA BOUNDARY

KEY INTERSECTION

DIRECTION OF FLOW

99 State Street
Traffic Impact and Access Study

FIG. IV A-1

The parcel under review currently consists of a surface parking lot, a mechanical garage and multi-story office buildings. Approximately 725 parking spaces are provided between the lot (25 spaces) and the garage. Normal use of the garage is somewhat less than the 700 spaces provided because of elevator capacity in the mechanical garage. The site also contains approximately 140,000 square feet of office and retail uses.

Roadway Network

In addition to Kilby Street and State Street, roadways in the area which will provide access to the immediate site include, Broad Street, Water Street and Exchange Place. The following provides a brief summary of roadway characteristics and use:

- State Street - a major connector between the Surface Artery and the northern CBD/southern Government Center Area. This 36-foot one-way roadway carries approximately 6,200 vehicles per day westbound. The key to traffic operation in the corridor is the Congress Street/State Street intersection, one block west of the State Street/Kilby Street intersection. While previous reports have indicated the intersection should function at an adequate level of service, the high degree of pedestrian activity, parking and loading/unloading activities east and west of the intersection leads to considerable queuing and delay on the State Street approach. This queuing, which at times extends easterly to Broad Street, is also affected by vehicles exiting from Kilby Street onto State Street, and desiring to turn right to Congress Street northbound, blocking the left lane. This blockage reduces the effect of the two-lane State Street approach to Congress Street.

- Broad Street - a low use roadway which serves a series of retail, restaurant and office uses with some warehousing between the Surface Artery and State Street. The roadway, which is generally 50 feet in width (although the width varies south of the site) carries a two-way total volume of 4,100 vehicles per day. Parking is permitted on both sides. The roadway has the right-of-way at all intersecting side streets except at State Street

(Stop sign controlled) and at the Surface Artery (traffic signal control).

- Kilby Street - This low-volume, one-way (northbound) roadway, extending from Milk Street to State Street, carries approximately 2,500 vehicles per day. South of Milk Street, Kilby Street is aligned with Oliver Street which provides a connection to High Street. The roadway provides the only entrance and exit to/from the Kilby Street garage and is the primary means of egress from the One Post Office Square Garage (on Oliver Street) to the north. Operations on Kilby Street, a 28-foot roadway adjacent to the site, are controlled by State Street. As previously described, operations at the State Street/Congress Street intersection result in queuing across Kilby Street, making it an undesirable route to use.

- Doane Street - This low volume, 20-foot roadway serves less than 500 vehicles per day. Primary use occurs during the evening peak period when vehicles leaving the Kilby Street Garage use the one-way (eastbound) roadway to reach Broad Street.

- Exchange Place is a two-way, 24-foot roadway which serves a relatively low volume of traffic between Congress Street and Kilby Street. Its primary function is to serve parking and loading requirements of the recently completed 53 State Street development.

- Water Street is a 25-foot local roadway serving circulating traffic between Broad Street and Kilby Street (one-way westbound) and eastbound vehicles between Congress Street (extending westerly to Washington Street) and Kilby Street. Its primary use during the morning peak is to provide access to the Kilby Street garage from east and west of the corridor.

SITE ACCESS PLAN

Architectural desires for pedestrian access to the site, open space within the structure, and traffic conditions on service roadways have led to definition of a site access and parking plan that locates vehicle access on Broad Street. After a review of several

basic options (and sub-options) which provided access to a 700-space underground parking area via Kilby Street and/or Broad street (via Doane Street), access to the garage only via Broad Street has been proposed.

The major benefits of this plan include:

1) A reduction in vehicles on Kilby Street with the associated improvement to operations at the Kilby Street/State Street intersection;

2) Better access to and egress from the site via the underutilized Broad Street corridor. Vehicles have the option to proceed in all directions from the Broad Street/Doane Street intersection. Broad Street is also the only two-way facility in the immediate area, reducing vehicle movement associated with circulation necessary to access a parking facility on a one-way roadway;

3) Isolation of parking trips from loading/delivery vehicles which will access the site from Kilby Place off of Kilby Street (see below);

4) Isolation of parking trips from the major pedestrian entrances located on Kilby Street opposite Exchange Place and from State Street;

5) The use of Doane Street approaching Broad Street as a ramp to the structure does not require the installation of a new curb cut. Elimination of all parking access from Kilby Street eliminates the need for several breaks in the sidewalk and no breaks will be made between Exchange Place and State Street. The latter is in an area of relatively high pedestrian activity.

Truck access and general loading and unloading activity will be via Kilby Place. This roadway currently serves as the entrance to the Kilby Street Garage from Kilby Street. It appears a minimum of five loading docks may be provided in a manner which will permit truck access without backing out of or into Kilby Street. Additional short-term parking for smaller delivery vehicles is being considered on the entrance level to the parking structure.

To improve access to and from the loading area, this analysis recommends a change to a two-way Kilby Street from Exchange Place to Liberty Square. From Liberty Square, vehicles are permitted to access Milk Street, Batterymarch Street and Oliver Street to leave the site. It is felt that this proposed change, which involves less than 100 feet of Kilby Street will serve to further reduce truck movement into the Kilby Street/ State Street intersection and consequently the State Street/Congress Street intersection.

SITE GENERATION RATES

Daily

In order to assess the impact of the project on the transportation system in the site area, travel demand estimates by type of use and user have been estimated. The procedures used in estimating those trips consisted of calculating person-trips per 1,000 square feet of floor space. Trips have been categorized as office vs. retail, and work vs. non-work. Rates used in the calculations are identical to those used in the recently completed Environmental Impact Report for International Place. (The percentages used in that study were derived from actual survey data and analysis indicated in previous studies including Copley Place EIR and the Boston Parking Study).

Tables 1 and 2 summarize rates and resultant person-trips based on the development plan, and mode split assumptions used in the analysis. Table 3 summarizes anticipated vehicle occupancy rates for those trips arriving by auto. The rates were based primarily on actual surveys of area employees.

TABLE 1
PERSON-TRIPS

User	Office Use In	Out	Total	Retail Use In	Out	Total
Generation Rates (per 1000 SF/day)						
Worker	4.40	4.40	8.80	2.75	2.75	5.50
Non-Worker	2.35	2.35	4.70	16.40	16.40	32.80
Total	6.75	6.75	13.50	19.15	19.50	38.30
Generated Trips (per day)						
Worker	3,014	3,014	6,028	41	41	82
Non-Worker	1,610	1,610	3,220	246	246	492
Total	4,624	4,624	9,348	287	287	574

TABLE 2
MODE SPLIT

User	Office Use Auto	Transit	Walk	Retail Use Auto	Transit	Walk
Percentages						
Worker	30	70	0	30	70	0
Non-Worker	27.5	57.5	15	27.5	32.5	40
Total Person-Trips						
Worker	1,808	4,220	0	24	58	0
Non-Worker	886	1,852	484	136	160	196

TABLE 3
VEHICLE OCCUPANCY FACTORS

Trip Type	Use Office	Retail
Work	1.8	1.4
Non-work	1.4	1.9

Applying occupancy rates to the auto arrivals projected in Table 2 results in a total of 1,726 vehicle-trips per day. These are distributed equally to inbound and outbound trips with 863 each way. The 1,726 vehicle-trips per day include employee related trips, visitors, taxis, and delivery vehicles. Refinement of the 1,726 trips to estimate taxi and delivery use suggests 50 taxi-related trips (3 percent of office non-employee arrivals as described in the Marketplace Center EIR) and 175 delivery-related trips (0.25 trips per 1,000 square feet).

Incremental Increases - Daily

Parking

While the development will result in a loss of approximately 25 parking spaces based on the maximum now available, all 700 spaces provided will be usable. The fact that all will be usable represents a gain of 300 spaces (estimated) because of the existing elevator capacity constraints of the current Kilby Street garage.

Vehicle-Trips

The existing parking garage experiences 350 +/- arrivals during the commuter period between 7:00-9:00 AM. Two hundred fifty of this total arrive during the morning peak hour. The rate of departure is somewhat less with only 200[1/] exiting during the 4:00-6:00 PM period, 110 of which leave during the peak hour.

Applying the known arrival total of 350 vehicles during the two-hour morning period and assuming approximately 100 additional arrivals through the rest of the day results in a total existing arrival and departure demand of 900 vehicle-trips per day. Allowing an additional 150 vehicle-trips per day for current land uses (actual calculated trip total of 300 per day, but assume half use the garage) results in an existing daily site damand of 1,050 trips per day.

A comparison of the existing rate to the projected new trip rate of 1,726 vehicle-trips per day indicates an

1/ BSC, Traffic Impact Study - 99 State Street, May 1984.

increase of approximately 676 vehicle-trips. The impact of the traffic to be generated by the proposed 99 State Street development varies by location. Assuming relocation of the access to the garage and drop-offs and deliveries from Kilby Street to Broad Street means an overall reduction in daily traffic on Kilby Street of approximately 39 percent and an increase in daily traffic on State Street of approximately 8 percent due to the development project. Table 4 summarizes the existing and projected daily traffic volumes on area roadways.

TABLE 4
DAILY TRAFFIC VOLUMES

Location	Existing (vpd)	Projected* (vpd)	Percent Increase
Kilby Street adjacent to site	2,500	1,520	-39%
Broad Street north of site access	4,125	4,675	+13%
Broad Street south of site access	4,125	4,480	+17%
State Street adjacent to site	6,200	6,690	+ 8%

* Increase (or decrease) due to 99 State Street development over existing conditions only.

ANALYSIS

With a construction schedule which commences in 1986 extending into 1988 or 1989, a design year of 1990 has been selected for review. This section has been prepared to qualitatively describe the impact of this development as it relates to the projected 1990 conditions. Results of a more detailed quantitative analysis will be provided as part of the Final BRA Environmental Assessment.

Future demands on the transportation system resulting from other projects now under construction, previously approved or under consideration have been defined in

various EIRs which have been recently completed. These include the International Place at Fort Hill EIR, Market Place Center EIR and the Third Harbor Tunnel/ Central Artery EIS. All suggest major increases in flow in the Surface Artery/Atlantic Avenue/Purchase Street corridor from Dock Square to Dewey Square. The magnitude of change due to projects such as these is on the order of an 80 percent increase in movement on the Surface Artery at State Street and Milk street and approximately 30 percent on the North Street approach to Dock Square during the evening peak hour.

The previous section has identified the generation of approximately 700 new trips with completion of the 99 State Street development. The splitting of these trips to inbound and outbound reduces the impact to 350 new vehicles inbound and 350 outbound on a daily basis. Further reduction to account for peak hour generation (approximately 20 percent of daily) and then applying projected distribution of those trips results in additional vehicle loadings of no more than 75 vehicles daily to the key intersections away from the site. This represents an increase of less than 5 percent of the 1990 Build Condition in all cases away from the immediate site area.

B Water and Sewer Service

INTRODUCTION

A preliminary analysis of water and sewer supply issues pertinent to the 99 State Street Project has been conducted in consultation with the Boston Water and Sewer Commission (BWSC). This section discusses the provision of sanitary sewerage, stormwater drainage, domestic water supply and fire-protection water supply to the study area.

DESCRIPTION OF THE ENVIRONMENT

Sewers

The project area is currently served by combined sewers which were constructed between 1860 and 1900. Sewage is conveyed from the project area to the Metropolitan District Commission (MDC) Deer Island Treatment Plant via combined sewers that connect to the East Side Interceptor and the Boston Main Interceptor. Combined sewers are common in older cities, and are designed to collect both sanitary wastewater and stormwater runoff from streets and rooftops. During storm events, overflow structures in the combined sewer system release mixed sanitary wastewater and stormwater when the flow exceeds the capacity of downstream interceptors. These overflow structures then discharge directly into nearby water bodies, primarily Boston Harbor.

Several combined sewer lines currently carry sewage from the project area. These lines converge at the intersection of Broad and Central Streets. From this point the sewage is carried by a 45" x 48" combined sewer running down Central Street toward the East Side Interceptor. At McKinley Square, near the Custom House Tower, a system of separate sanitary sewer and storm drainage lines begins. A diagram of the sewer system serving the project area, is presented in Exhibit IV B-2.

The East Side Interceptor and the Boston Main Interceptor carry sewage to the MDC Deer Island Treatment Plant (see Exhibit IV B-1). The East Side Interceptor begins north of Commercial Street at Battery Street and extends southerly along Commercial Avenue, Atlantic Street, and Atlantic Avenue. It ultimately connects with the Boston Main Interceptor at Massachusetts Avenue, which in turn connects to the MDC Columbus Park Headworks. Sewage is pumped from the Headworks to the Deer Island Treatment Plant via the 138-inch diameter

Boston Main Drainage Tunnel. At Deer Island, sewage receives primary treatment and chlorination before being discharged into Boston Harbor.

Replacement of the East Side and Boston Main Interceptors is underway as part of an ongoing $60 million Boston Water and Sewer Commission (BWSC) construction program designed to improve the interceptor's operations. Construction of the new interceptors began in 1982 and is scheduled for completion in 1989, assuming no delays due to depression of the Central Artery. The new East Side Interceptor will extend from Widett Circle in South Boston to Rowes and Fosters Wharves at Atlantic Avenue in downtown Boston. A segment of the new interceptor that runs from Hanover Street to Harbor Towers has already been completed. This segment has a capacity of 36 mgd, but is currently limited by the 9 mgd capacity of the rest of the interceptor.

The combined sewer line in Kilby Street currently consists of a 12" line that runs through the portion of the street between Doane and Central Streets. Due to a collapsed section of pipe in the 12" line, this sewer cannot carry sewage at its design capacity, and cannot accept additional flows.

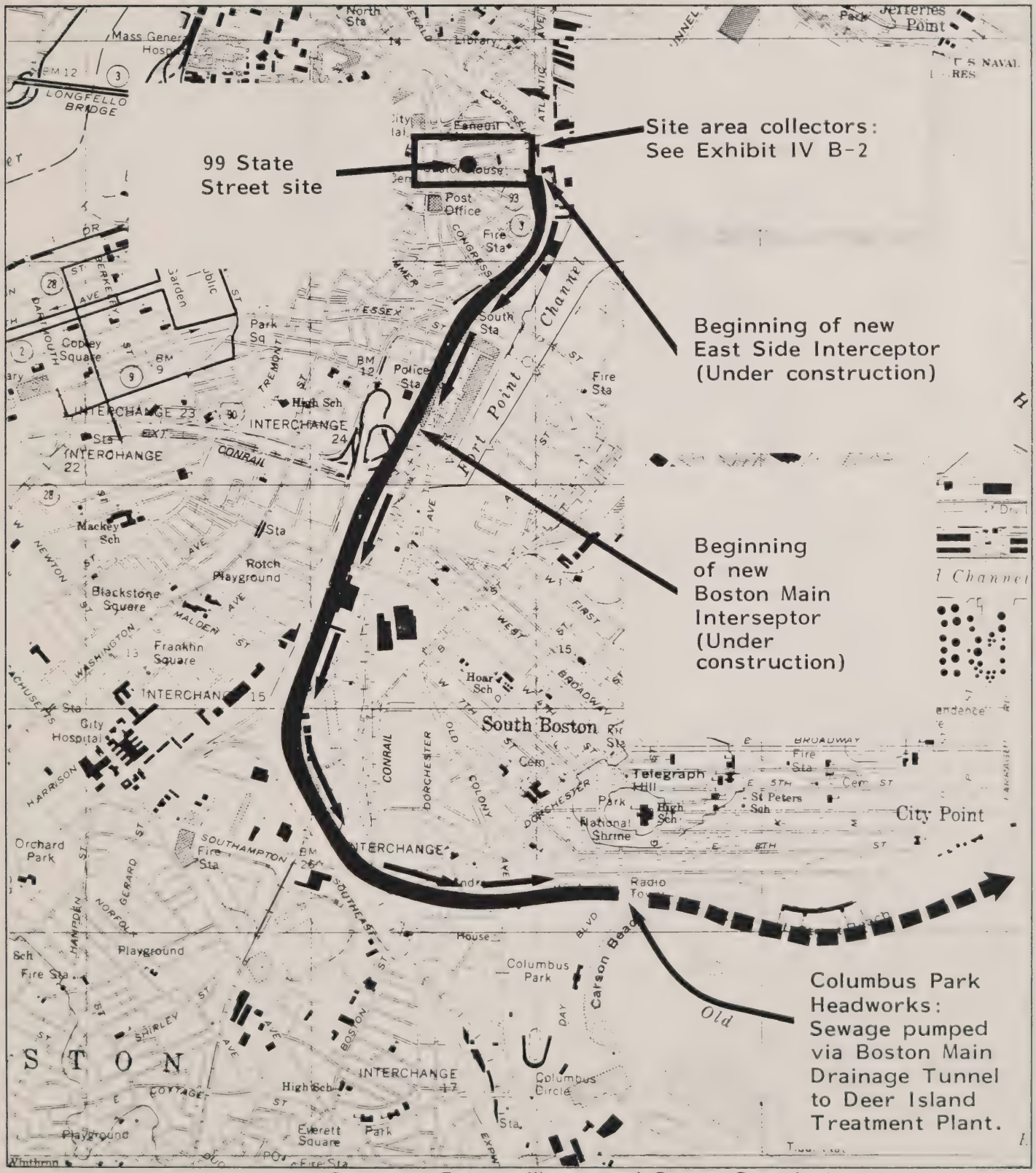
System Issues

Combined Sewer Overflows. The discharges from combined overflows into the Harbor are a source of pollution during heavy rain storms. However, dry weather (non-storm) discharges also occur at certain combined sewer outlets, and are illegal. Dry weather discharges are caused primarily by insufficient system capacity, tidal waters entering the system, and pumping failures at the Deer Island Treatment Plant.

Infiltration/Inflow. Infiltration and inflow issues are not relevant in the sewer system analysis for this project. The project area is served by combined sewers which are not subject to inflow problems which are common in separated systems. Infiltration issues have not been studied by BWSC in this area.

Tidal Conditions. Another cause of sewer overflows into Boston Harbor is the effect of tidal conditions. Tide gates installed on overflow pipes to keep incoming

Exhibit IV B-1 SEWERAGE TO DEER ISLAND



Source: Boston Water and Sewer Commission

Exhibit IV B-2

SITE AREA SEWERAGE

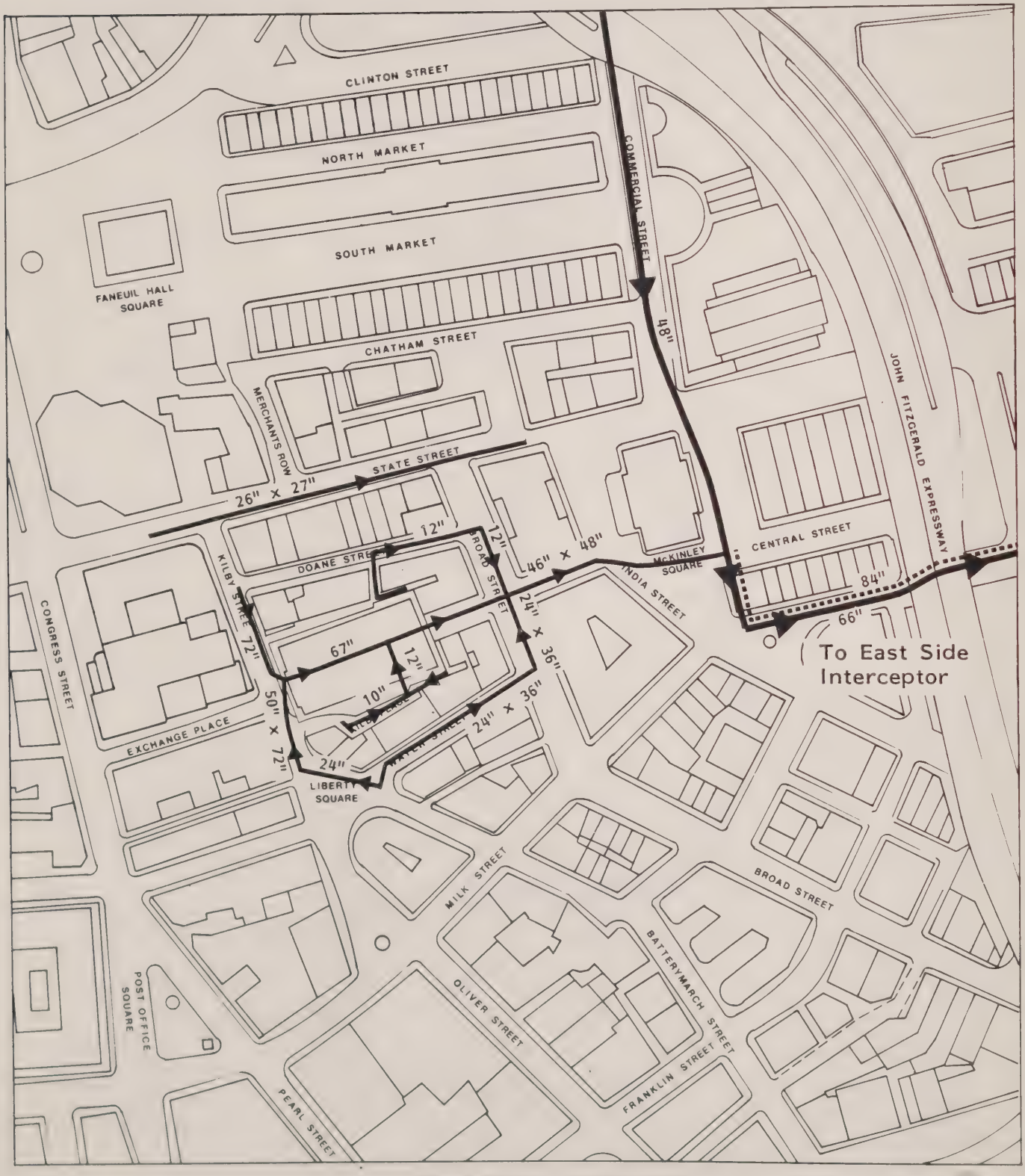
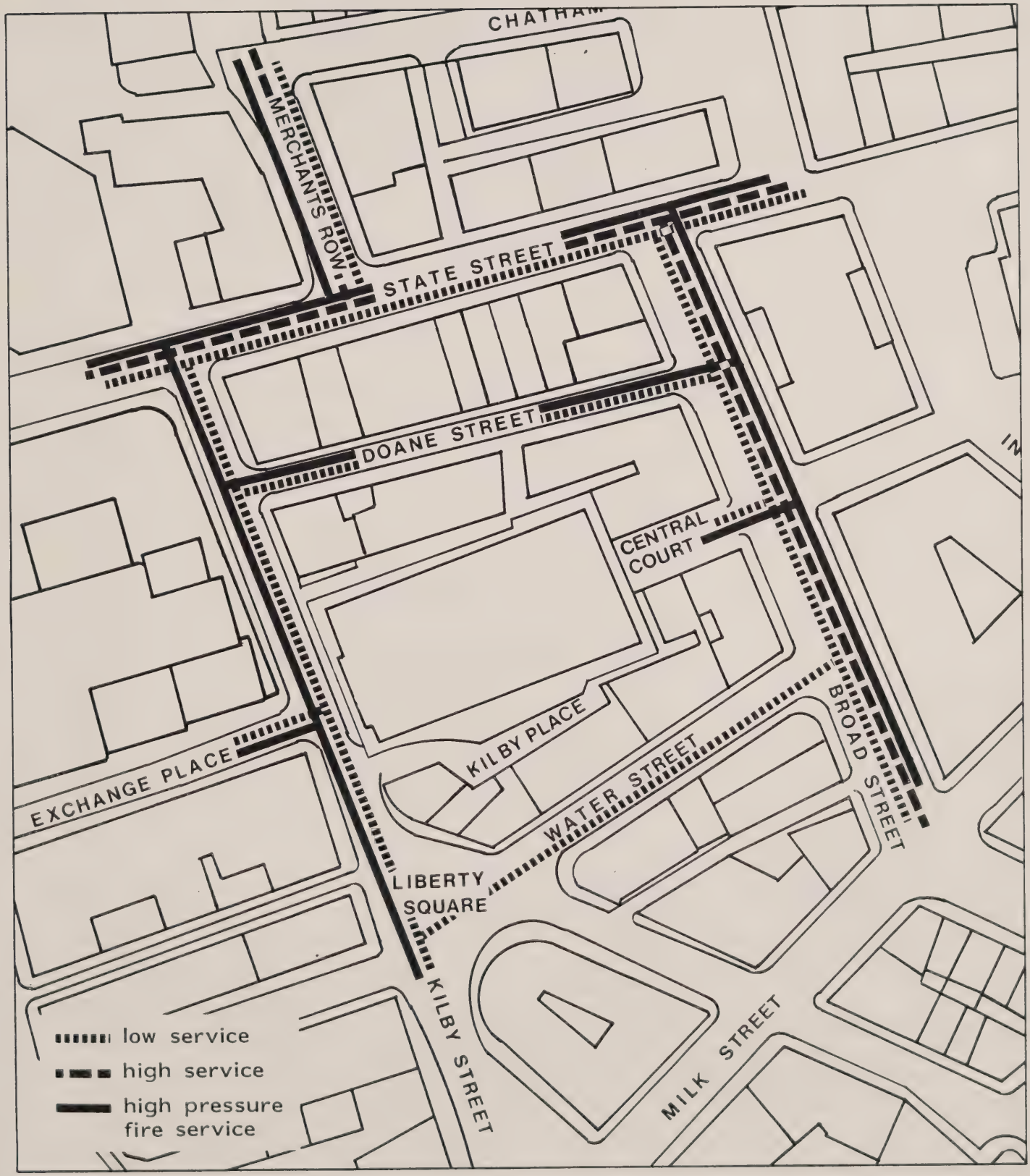


Exhibit IV B-3

SITE AREA WATER SUPPLY



tide waters from entering the sewer system often malfunction, allowing a significant volume of seawater to enter the system during high tide. This seawater limits the hydraulic capacity of the sewer system, prevents conveyance of wastewater, and results in a surchaged condition. As the tide recedes the tide gates open to relieve the surcharged system, discharging dry weather flow into the Harbor. The East Side Interceptor currently experiences surcharged conditions during high-tide periods. Recommendations were made in the 1982 CSO Project Inner Harbor Area Facilities Plan to repair and maintain these gates.

Storm Drainage

The combined sewers that currently serve the project area carry both sanitary sewage and storm drainage. In order to improve the system, the BWSC will no longer accept the use of combined sewers to carry storm runoff for new development projects in this area of Boston. Street drainage issues will be examined as the project design progresses.

Water Supply

The project area is currently served by the MDC water supply system for low (domestic) service, high (fire/building sprinklers) service, and high pressure (street hydrant) service. The Quabbin Reservoir is the source of this water (see Exhibit IV B-3). Eight inch mains provide low service water to the project area, and 12" mains provide high service water to the project area. A 12" main provides high pressure fire service. Currently no significant problems are known to affect the provision of water services to the project area.

PROBABLE PROJECT IMPACTS

The proposed project will create increased demands for sewage and water supply services for the site, as compared to existing conditions. Estimates of these increased demands and their impacts on the current infrastructure system are discussed below. Since the site is already covered entirely by impervious surfaces, site development will not generate additional storm runoff.

Sewers

Sewage to be Generated by Project

Sewage to be generated by the planned project has been projected at 52,125 gallons per day (gpd). The calculation of this estimate was based upon standard sewage flow rates for various land uses as detailed in Title V of the Massachusetts Department of Environmental Quality Engineering Sanitary Code. Sewage flow was calculated as follows:

Office Section:
(685,000 sf) x (75 gpd/1,000 sf) = 51,375 gpd

Retail Section:
(15,000 sf) x (5 gpd/1,000 sf) = 750 gpd

52,125 gpd

The 140,000 square feet of office space currently existing on the site generates approximately 10,500 gpd of sanitary sewage according to Title V-based estimates. Therefore the flow to be generated by the project represents an incremental increase of 41,625 gpd over present conditions.

Adequacy of Sewer System

The project's sanitary sewer system may connect into the 45" x 48" combined sewer line which runs along Central Street to the East Side Interceptor. In the immediate area of the project site, adaptations must be made to the existing combined sewer system. The capacity and flows of the Broad Street combined sewer pipe will be investigated to determine whether it can adequately carry flows from the project to the Central Street combined sewer. No new connections can be made to the Kilby Street sewer due to its deteriorated condition. The BWSC requires that any sewer lines which need to be rebuilt or relocated be constructed as separated, not combined, systems.

The segment of the Central Street combined sewer that runs through the project site serves a large area and receives discharges from the buildings on the south side of Doane Street and from the buildings on Water

Street via sewers in Bangs Alley and Kilby Place. The existing 67" combined sewer line is a major trunk line serving the area and carries substantial peak combined sewage flows during rainfalls. Since this segment will be removed as a result of site development, it must be relocated or replaced. Prior to abandonment of the existing sewer, building services must be connected to the new sewer.

Several options for relocation of this line are being examined. These options include relocating the sewer along either Water Street or Kilby Place. Relocation down Kilby Place would run the line around the perimeter of the proposed building, and reconnect it at Central Place. Relocation or additional connections cannot be made to the State Street sewer due to the complications posed by the subway tunnel underneath the street.

Additional analysis to study the capacity of area sewers to properly serve the project will be conducted before filing the application for a Massachusetts Sewer System Connection Permit, which is required of all projects generating more than 2,000 gpd. The permit is reviewed jointly by BWSC and the Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control. The purpose of the permit is to monitor types of discharge, prevent inadequacies in project design, and avoid overburdening of the public sewer system capacity. Submission of the Sewer Connection Permit application will include the locations and details of the project's sewers and drains, including the size, type, material, and elevation of all sanitary sewage drainage lines.

Storm Drainage

Since the site is already covered by impervious surfaces, the project will not generate any additional storm drainage. However, storm drainage generated by the site cannot be introduced into the combined sewer system as is done currently. A separated drainage system must be provided. Reconstruction of the 67" combined sewer line that presently runs through the center of the site would entail the construction of two parallel lines--a sanitary sewer line and a storm drainage line. The Kilby Street sewer also could be reconstructed as a storm drainage line for the site.

In either case a main drainage line would be necessary to carry storm drainage from the site to McKinley Square, where storm runoff is carried by a separate drainage line out to Central Wharf and sanitary sewerage is carried by the East Side Interceptor. To improve street drainage, new catch basins may be required in Broad and Kilby Streets.

Water Supply

Water Demand to be Generated by Project

Demand for water to be generated by the project has been projected at 58,800 gpd. This estimate is also based upon the Title V standards, and was calculated as follows:

(52,125 gpd sewage flow) x (115%) = 58,800 gpd.

The total make-up water due to evaporation from the air conditioning system is not anticipated to be significant, and therefore is not included in the above estimate.

Existing uses on-site, consisting of 140,000 square feet of office space, currently generate a demand for water of approximately 12,075 gpd according to Title V-based estimates. Therefore the incremental demand for water due to site development is estimated at 46,725 gpd.

Adequacy of Water System

The water supply lines to be affected by the proposed project are the low service and high pressure fire service lines in Doane Street, which will be relocated/replaced during the course of development. Any domestic services affected by taking out the 8" low service line in Doane Street can be serviced from the State Street main. This configuration also preserves loop service for the area.

The high pressure fire service in Doane Street will also be relocated during the course of site development, perhaps requiring two new connections. A new line is anticipated to be constructed along Broad

Street connecting the end of the Broad Street line, at the current junction of Doane and Broad Streets, to the Central Street line. According to the analysis conducted to date, this service would probably consist of a 12" line. The other connection would run from the north end of Kilby Street to the existing line in Merchants' Row. The removal of the two hydrants in Doane Street caused by the relocation of this high pressure fire service line will necessitate the installation of a new hydrant on Broad Street near the intersection of Doane Street. Such a configuration will also preserve high pressure fire loop service to the area.

MITIGATION MEASURES

In an effort to mitigate adverse impacts of the project upon the existing sanitary sewer, storm drainage, and water supply systems, the systems discussed in the previous section will be further examined by the consulting engineers as part of an ongoing review process with BWSC. Regardless which systems are adopted, the following mitigation measures will be provided.

Sewers

To avoid contributing to surcharged conditions in the East Side Interceptor during high-tide periods, the planned project will utilize a storage tank system to hold sewage on-site until low-tide periods. At that time the sewage will be discharged into the the sewer system by an automated pump system. BWSC requirements stipulate that new connections tributary to the East Side Interceptor for facilities producing more than 10,000 gpd incorporate sewage holding tanks into the project design. The proposed project will provide a storage tank system designed to comply with these requirements.

The planned system will utilize storage tanks of reinforced concrete construction. Waterproofing will be applied on all surfaces, in addition to other appropriate measures to ensure a watertight, leak-proof system. The tanks will be able to accomodate a 24-hour capacity and a maximum 13-hour flow between low-tide periods. Lift pumps will be utilized to discharge sanitary sewer wastes into the sewer system. Pumping will be designed to occur two hours before until two

hours after low tide--for a total of four hours of pumping for each sequence. The system will be equipped with an emergency power connection through the project's emergency generator. A tide clock controller will be programmed to operate the pumps during designated low-tide periods. The tide schedule programmed into the controller will be based upon U.S. Coast Guard data for Boston Harbor tides. An automatic recording device for pump activation and collection of volume discharge data may also be incorporated.

In addition to the storage-tank system, a variety of other mitigation measures will be used to minimize adverse effects associated with sewage generation. Grease traps that meet Title V requirements will be provided at any restaurant kitchen facilties. Oil/gasoline traps will be provided at the discharge point of the garage drainage system. These facilities will be maintained by project personnel and will meet the requirements specified by BWSC regulations. All wastewater facilties serving the project will be constructed in conformance with BWSC standards and specifications.

Storm Drainage

Adverse impacts upon the existing combined sewer system caused by existing storm drainage will be mitigated through the use of separate storm drainage lines, as required by BWSC.

Water Supply

According to BWSC, it is not anticipated that adverse impacts upon the water supply system will result from the project, especially if loop service of adequate capacity for both the low and high service fire lines is maintained in the project area.

Additional Analysis

Additional, more detailed analysis of existing conditions and potential impact mitigation strategies are currently being conducted in conjunction with the City of Boston and BWSC. This additional analysis will be presented in the BRA Final Environmental Assessment.

C Wind Conditions

INTRODUCTION

Wind tunnel testing was initiated in the early phases of the design process for the 99 State Street Project to assess the possible effects of the proposed development on the ground-level pedestrian environment in and around the site. Tests were conducted at the Wright Brothers Memorial Wind Tunnel at MIT. Preliminary evaluation of the wind tunnel test results suggests that project development under any of the alternative development scenarios will not cause pedestrian-level wind conditions to exceed wind guidelines established by the BRA.

METHODOLOGY

Hot-wire tests, conducted at MIT in April and May 1985, were used to investigate pedestrian-level wind conditions at specific locations (referred to as stations) in and around the project site (see Exhibit IV C-1). The hot-wire technique records the varying wind velocities as a function of time at pedestrian-level height.

The Hot Wire Test

A 1:400 scale model of the 99 State Street project site and all of the buildings and open spaces within a 1,600-foot radius of the site was placed in the wind tunnel. Four configurations were tested--one that modeled the existing buildings on the site, and three that substituted models of each of the three design alternatives for the proposed 99 State Street Project.

Spires and roughness blocks were installed in the wind tunnel to simulate a wind profile characteristic of densely built urban areas such as the area surrounding the project site. Hot-wires were used to measure pedestrian-level velocities for winds from the sixteen major compass directions. From the data, the average, root mean square variation about the average (rms), and the peak two-second gust wind velocities were measured. An effective gust velocity equal to the average plus 1.5 times the rms was calculated. These three velocities--the average, effective gust, and peak gust--were weighted with a statistical description of the Boston wind conditions that was determined from wind roses compiled from seasonal and annual wind velocity direction and magnitude data collected over a 20-year period at Logan Airport to predict: (i) the hourly average velocity; (ii) the effective gust velocity; and (iii)

the peak gust velocity that will be exceeded one percent of the time at each station.

To simplify the analysis of the data, the effective and peak gusts were converted to an "equivalent average." This allowed each of the three velocities to be compared on the same scale. Since each of these three velocities are measures of "windiness," the highest of the average and the two equivalent average velocities was used to evaluate pedestrian-level wind conditions at each station, and is referred to as the "equivalent average velocity."

Comfort Criteria

In order to evaluate the pedestrian-level effects of wind velocities, the predicted velocities obtained from the wind tunnel analyses were evaluated with respect to the BRA wind guideline discussed in the following section, and with respect to the Melbourne Criteria, an international standard that has been used by the Wright Brothers Wind Tunnel for the past six years.

BRA Guideline

Based upon the effective gust velocity, the BRA wind guideline has developed over a number of years through a series of wind tunnel tests conducted for specific sites in Boston. The guideline establishes a maximum effective gust velocity of 31 mph not to be exceeded more than one percent of the time. This condition is usually referred to as the "100-hour return period effective gust velocity" since it is probable to occur during one hour in every 100 hours. The BRA guideline can be translated into an equivalent average wind speed criteria for a 100-hour return period of 22 mph.

Melbourne's Criteria

The second set of criteria applied to the wind velocity data in this study was developed by W. H. Melbourne. The extensive use of Melbourne's criteria in pedestrian-level wind speed analysis has set the precedent for evaluating the wind velocity data obtained from the hot-wire test conducted for the 99 State Street Project according to Melbourne comfort criteria, in addition to

the BRA guidelines. Based upon a literature review of past studies and other wind comfort criteria, Melbourne developed a criteria for hourly average pedestrian-level wind speeds defined by safety considerations and different types of human activity accommodated by each level of wind speed.

Melbourne established five levels of human comfort criteria: unacceptable and dangerous, uncomfortable for walking, acceptable for walking, acceptable for short periods of standing, and acceptable for long periods of standing or sitting. A characteristic range of hourly average pedestrian-level wind speeds with a one percent probability of occurrence can be assigned to each criteria. The equivalent average velocities for each of Melbourne's comfort criteria have been calculated and are presented below:

MELBOURNE'S CRITERIA FOR 100-HOUR RETURN PERIOD VELOCITIES

CATEGORY	
Comfort Criteria	Equivalent Average (Uav) (mph)
1 Unacceptable/Dangerous	$27 \leq Uav$
2 Uncomfortable for Walking	$19 \leq Uav < 27$
3 Acceptable for Walking	$15 \leq Uav < 19$
4 Stationary Short Exposure	$12 \leq Uav < 15$
5 Stationary Long Exposure	$0 \leq Uav < 12$

The threshold velocity between acceptable for walking and uncomfortable for walking in Melbourne's criteria will be considered the equivalent of the BRA guideline velocity. Given that assumption, the equivalent average wind velocity thresholds of Melbourne's criteria are less (i.e., more stringent) than the corresponding threshold velocities used by the BRA:

	BRA Guideline	Melbourne Criteria
Equivalent Average Velocity	22 mph	19 mph

DESCRIPTION OF THE ENVIRONMENT

Pedestrian-level wind conditions at sixteen stations in the vicinity of the project site were studied in the hot-wire test (see Exhibit IV C-1). For existing conditions these sixteen stations were found to experience moderate pedestrian-level wind conditions, as measured by the equivalent average wind velocity. Seven stations (8, 11, 12, 13, 14, 15, and 16) experience winds within Melbourne's "stationary long exposure" comfort category. Five stations (3, 5, 6, 7, and 9) fall within the "stationary short exposure" category, and four stations (1, 2, 4, and 10) experience pedestrian-level winds "acceptable for walking." None of the stations tested experienced wind conditions that were either "uncomfortable for walking" or "unacceptable/ dangerous," according to Melbourne's criteria, and none of the stations exceeded the BRA guideline for the equivalent average pedestrian-level wind velocity.

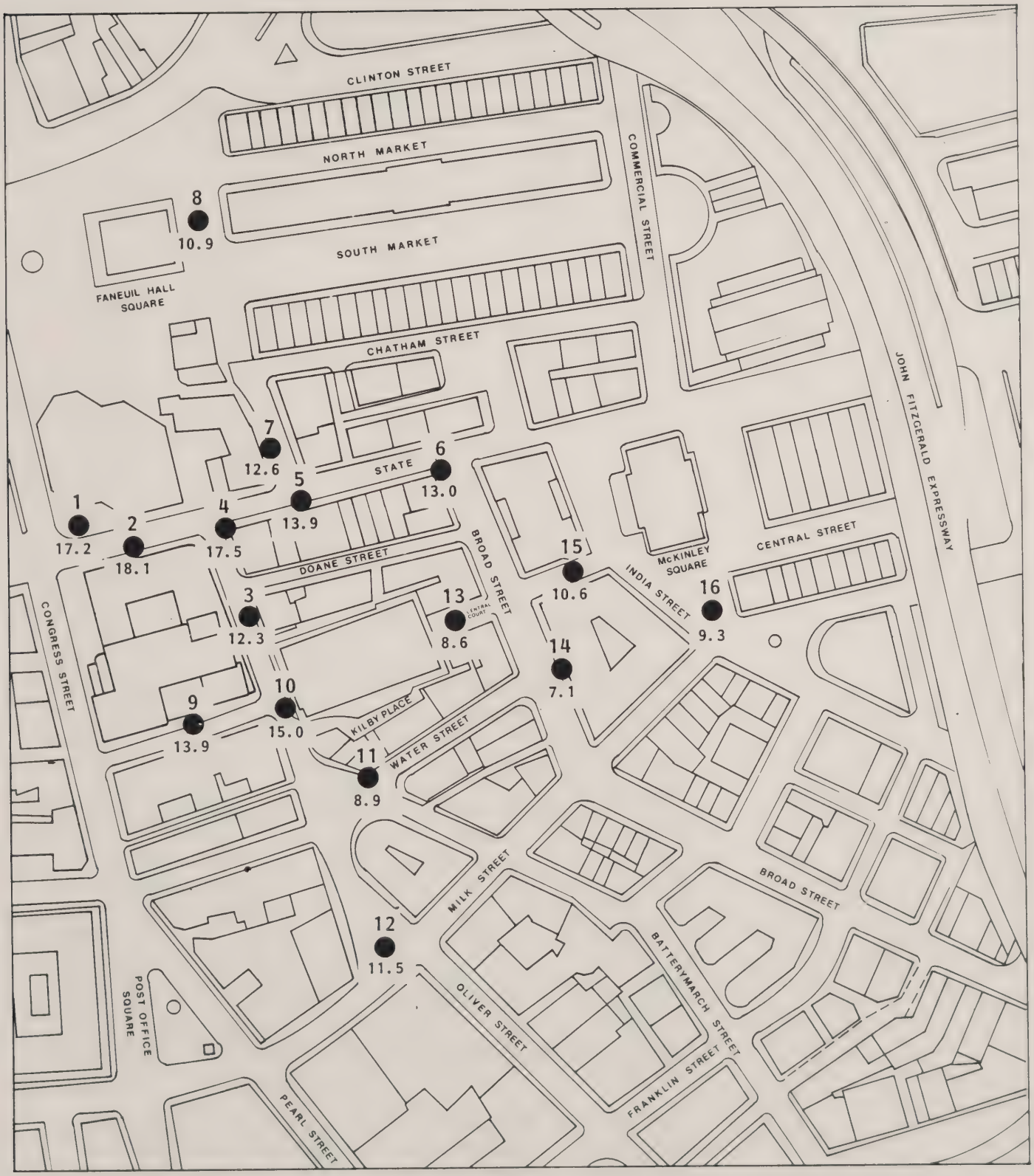
PROBABLE PROJECT IMPACTS

The data evaluated from the hot-wire test for pedestrian-level winds in the vicinity of the project site compares changes in the equivalent average velocity between existing conditions and future conditions under each of the three project alternatives. Based upon current data collected at the Wright Brothers Wind Tunnel, changes in velocity of greater than 0.5 mph are considered to be statistically significant. Therefore pedestrian-level wind conditions at stations that experienced a difference of less than 0.5 mph in equivalent average velocities were considered to remain unchanged. Under this assumption, at a majority of stations tested, pedestrian-level wind speeds in the vicinity of the project site will not change or will be slightly reduced with any of the three project alternatives in place.

Most stations will fall within Melbourne's criteria for acceptable for walking, stationary short exposure, and stationary long exposure. All stations will be within the BRA guideline. No development alternative caused any of the stations to become either Melbourne's "unacceptable/dangerous" category or exceed the BRA guideline.

Exhibit IV C-1

EXISTING CONDITIONS
Equivalent Average 1% Velocities (mph)



Key: # Station Number

● # Wind Velocity

EQUIVALENT AVERAGE 1% VELOCITIES (MPH)

Station	Existing	Alternative 1	Alternative 2	Alternative 3
1	17.2	17.6	17.3	17.0
2	18.1	19.1	19.9	19.7
3	12.3	14.2	13.3	13.6
4	17.5	16.0	16.6	16.4
5	13.9	14.7	15.0	14.5
6	13.0	12.9	11.2	11.7
7	12.6	12.3	13.1	13.2
8	10.9	11.1	11.2	10.7
9	13.9	9.9	10.6	10.7
10	15.0	20.9	20.1	19.8
11	8.9	9.5	11.2	10.9
12	11.5	11.5	11.6	11.5
13	8.6	7.3	8.0	8.3
14	7.1	8.1	9.4	9.2
15	10.6	10.9	8.5	8.3
16	9.3	9.3	8.9	9.0

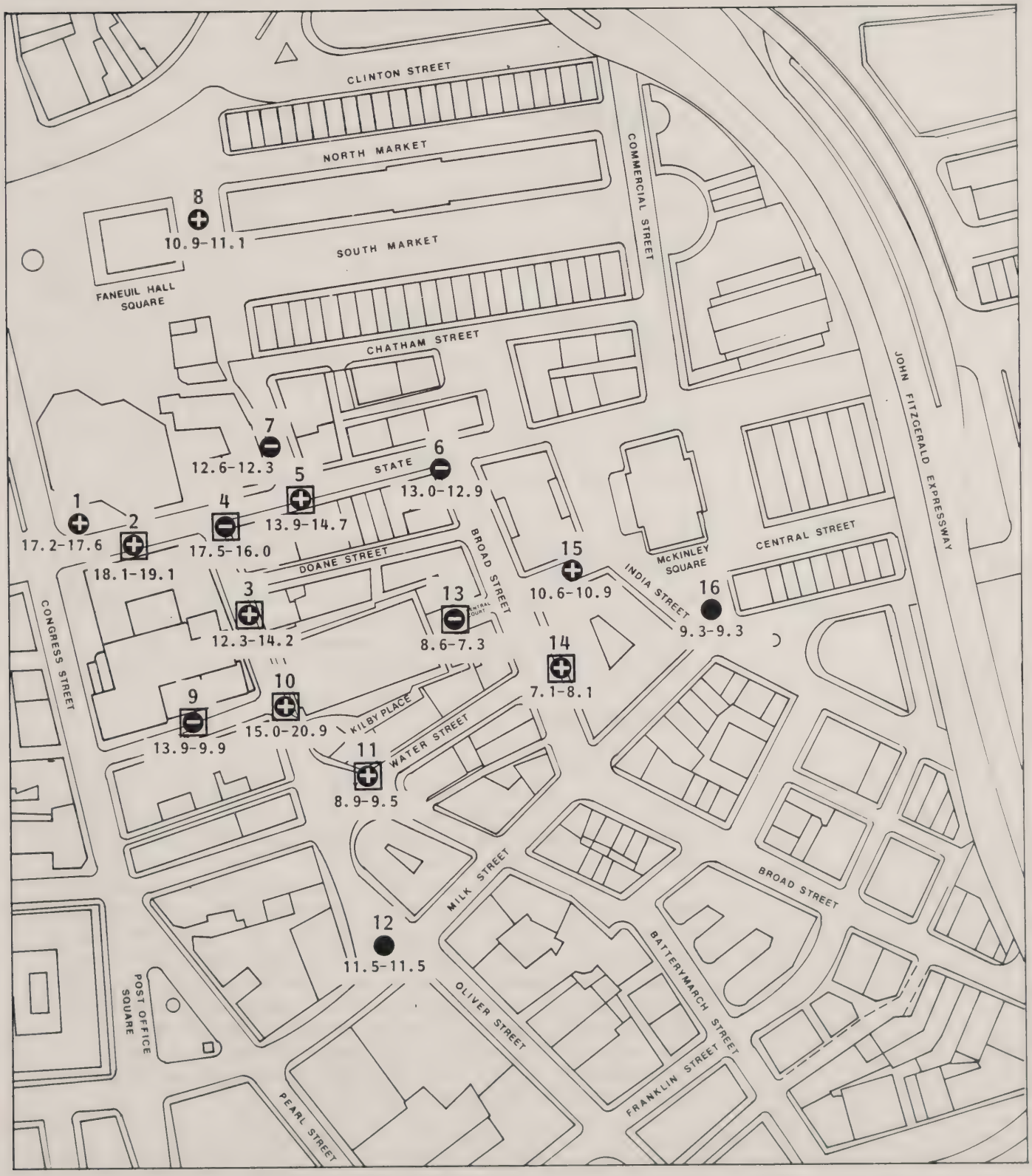
Alternative 1

With Alternative 1 in place, nine stations (1, 2, 3, 5, 8, 10, 11, 14, and 15) in the vicinity of the project experienced increased pedestrian-level wind velocities (see Exhibit IV C-2). Only six of these nine stations demonstrated changes in velocity greater than 0.5 mph (stations 2, 3, 5, 10, 11, and 14). Five stations (4, 6, 7, 9, and 13) experienced decreased velocities, and two stations (12 and 16) experienced velocities that were equal to those experienced under existing conditions. Three of the five stations that demonstrated decreased pedestrian-level winds experienced decreases in velocity that were greater than 0.5 mph (stations 4, 9, and 13). Assuming changes in magnitude of the equivalent average velocity of less than 0.5 mph are not statistically significant, a total of seven stations (1, 6, 7, 8, 12, 15 and 16) demonstrated pedestrian-level wind conditions that were unchanged from existing conditions.

According to Melbourne's criteria, one station (9) became more comfortable, reaching the level for

Exhibit IV C-2

ALTERNATIVE 1
Equivalent Average 1% Velocities (mph)



Key: # Station Number

●
#-# Existing Velocity-Projected Velocity

⊕ Increase

⊖ Decrease

☐ Statistically Significant Change

"stationary long exposure." Two stations (2 and 10) moved from "acceptable for walking" to "uncomfortable for walking." However, none of the stations exceeded the BRA guideline with Alternative 1 in place.

Alternative 2

With Alternative 2 in place, ten stations (1, 2, 3, 5, 7, 8, 10, 11, 12, and 14) experienced increased wind velocities (see Exhibit IV C-3). Seven of those stations demonstrated increases of a significant magnitude greater than 0.5 mph (stations 2, 3, 5, 7, 10, 11, and 14). The remaining six stations (4, 6, 9, 13, 15, and 16) all experienced decreased pedestrian-level wind speeds, with five of those six stations demonstrating changes in velocity greater than 0.5 mph (stations 4, 6, 9, 13, and 15). Under the assumption that changes in magnitude of the equivalent average velocity of less than 0.5 mph are not statistically significant, a total of four stations (1, 8, 12, and 16) demonstrated unchanged pedestrian-level wind conditions.

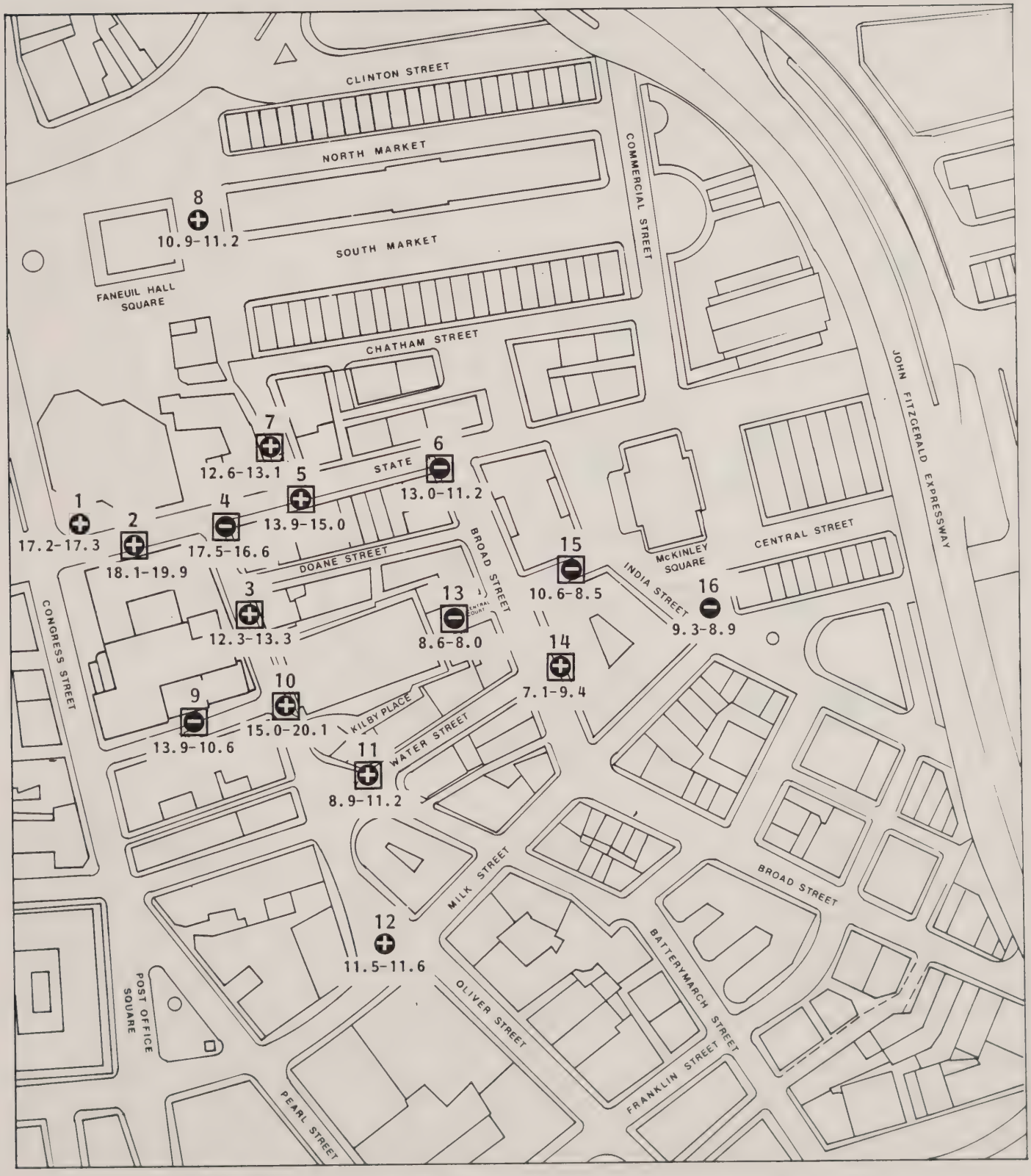
Two of the stations (6 and 9) that demonstrated decreased wind speeds experienced conditions enabling them to become Melbourne's category "stationary long exposure." Three stations (2, 5, and 10) experienced conditions which moved them to less acceptable Melbourne's criteria levels. None of the stations exceeded the BRA Guideline with Alternative 2 in place.

Alternative 3

With Alternative 3 in place, seven stations (2, 3, 5, 7, 10, 11, and 14) experienced increased pedestrian-level wind velocities, with all stations demonstrating those increases to be significant in magnitude greater than 0.5 mph (see Exhibit IV C-4). Eight stations (1, 4, 6, 8, 9, 13, 15, and 16) experienced decreased wind velocities. Of those eight stations, four demonstrated changes that were greater than 0.5 mph (stations 4, 6, 9, and 15). One station (12) did not experience any change in pedestrian-level wind velocity with Alternative 3 in place. Assuming that changes in magnitude of less than 0.5 mph in the equivalent average velocity are not statistically significant, a total of five stations (1, 8, 12, 13, and 16) demonstrated unchanged pedestrian-level wind conditions.

Exhibit IV C-3

ALTERNATIVE 2
Equivalent Average 1% Velocities (mph)



Key: # Station Number

#-# Existing Velocity-Projected Velocity

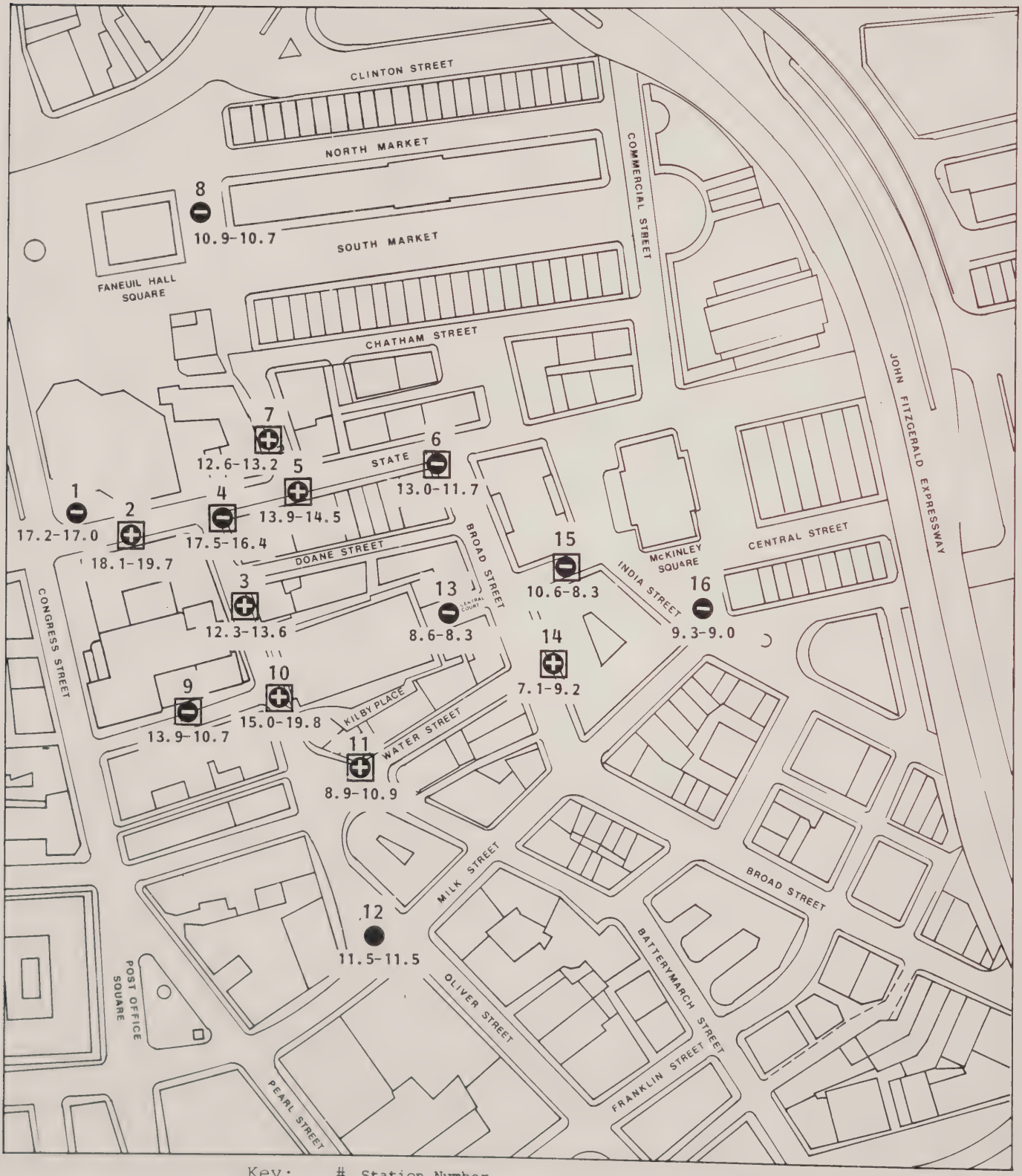
⊕ Increase

⊖ Decrease

☐ Statistically Significant Change

Exhibit IV C-4

ALTERNATIVE 3
Equivalent Average 1% Velocities (mph)



Key: # Station Number

#-# Existing Velocity-Projected Velocity

Increase

Decrease

Statistically Significant Change

Two stations (6 and 9) experienced improved wind conditions enabling them to move to Melbourne's criteria level of "stationary long exposure." Two other stations (2 and 10) moved to a less acceptable Melbourne's criteria level. As with Alternatives 1 and 2, no stations were made to exceed the BRA guideline with Alternative 3 in place.

Conclusion

Under existing conditions, the stations tested in the project area experience low-to-moderate equivalent average pedestrian-level wind velocities that fall within the more comfortable levels of Melbourne's criteria. These velocities are also below the BRA guideline for the equivalent average velocity. Preliminary analysis of the hot-wire data suggests that with any of the three project alternatives in place, some stations will experience slight changes in pedestrian-level winds (only station 10 experienced a large change in velocity), while many stations will experience conditions that will remain unchanged. If changes in magnitude of the equivalent average velocities of less than 0.5 mph are assumed to be statistically insignificant, the majority of individual stations will experience either reduced or unchanged equivalent average velocities. Most stations will remain within Melbourne's criteria levels for comfortable for walking, stationary short exposure, and stationary long exposure. No stations will become "uncomfortable/dangerous" and all stations will remain within the BRA guideline velocity.

MITIGATION MEASURES

Preliminary evaluation of the hot-wire wind tunnel test suggests that project development with any of the three design alternatives in place will not cause pedestrian-level wind conditions to exceed the guidelines established by the BRA. Further wind tunnel testing will be completed for the final BRA Environmental Assessment. If these tests identify adverse wind conditions, measures to mitigate these effects will be investigated as part of the design review process.

D Shadow

INTRODUCTION

A series of computer-generated shadow analyses have been performed for the 99 State Street Project to predict and evaluate the extent of new project-generated shadows. The study area included approximately 45 blocks bounded by City Hall Plaza, Court Square, Franklin Street, the Waterfront and the intersection of Endicott Street and New Sudbury Street. Shadows cast by the project were superimposed on existing shadows to show where new shadows would occur. With the exception of brief periods of new shadow occuring in the Quincy Market "Jugglers Area" during the morning in late Fall and early Spring, no significant shadow impacts were found to occur as a result of any of the development alternatives.

For this analysis, the three building massing alternatives described in Chapter III were evaluated and compared to existing conditions. These alternatives differ as follows:

- Alternative 1

  Total height = 238 feet to parapet (263 feet to mechanical), 19 stories
  Base element = 116 feet, 9 stories

- Alternative 2

  Total height = 370 feet to parapet (395 feet to mechanical), 30 stories
  Base element = 67 feet, 5 stories

- Alternative 3

  Total height = 410 feet to parapet (435 feet to mechanical), 33 stories
  Base element = 67 feet, 5 stories

Shadow analyses were conducted for three times of day -- 9:00 AM, Noon, and 3:00 PM -- for the following days:

- March 21 (Vernal Equinox, average shadow conditions equivalent to those on September 21, the Autumn Equinox)

- June 21 (Summer Solstice, minimum shadow conditions, conducted under daylight savings time conditions)

- December 21 (Winter Solstice, maximum shadow conditions)

A more detailed study of the "Jugglers Area" between Faneuil Hall and the central Quincy Market building was also conducted due to the importance of this area as a focus of pedestrian activity. Analysis was conducted for the only periods during which previous studies have indicated that shadow effects may occur in this area. The analysis was conducted for five time of day -- 10:00 AM, 11:00 AM, noon, 1:00 PM and 2:00 PM -- for the following days:

- October 21

- November 21

"Juggler Area" shadow studies are presented graphically in Exhibit IV D-2, and are accompanied by a discussion of findings. Of the March, June, December series conducted for the overall project vicinity, shadow conditions are described in this section, but only shadow conditions which occur during June 21 are graphically portrayed (see Exhibit IV D-1). This is due to the fact that the production/submission schedule for this document only allowed sufficient time to print computer-diagrams for one of the three conditions analyzed. The June 21 condition was selected for presentation due to peak pedestrian activity which occurs in the project area during that time. March 21 and December 21 shadow conditions will be graphically portrayed in the Final BRA Environmental Assessment.

OVERALL PROJECT VICINITY

March 21 (Vernal Equinox)

ALTERNATIVE 1

- 9:00 AM - As compared to existing conditions, the proposed building produces a new shadow at the entrance to 60 State Street, filling a small gap between two larger shadows.

- Noon - No new shadow.

- 3:00 PM - No new shadow.

ALTERNATIVE 2

- 9:00 AM - As compared to existing conditions, the proposed building produces a new shadow at the entrance to 60 State Street in addition to producing a small area of new shadow over Congress Street north of State Street.

- Noon - No new shadow.

- 3:00 PM - As compared to existing conditions, the proposed building produces a small shadow to the south of Marketplace Center.

ALTERNATIVE 3

- 9:00 AM - As compared to existing conditions, the proposed building produces a new shadow at the entrance to 60 State Street in addition to producing a small area of new shadow over Congress Street north of State Street.

- Noon - No new shadow.

- 3:00 PM - As compared to existing conditions, the proposed building produces a small shadow to the south of Marketplace Center.

June 21, Summer Solstice (see Exhibit IV D-1)

ALTERNATIVE 1

- 9:00 AM - No new shadow.

- Noon - As compared to existing conditions, the proposed building casts a shadow on the roof of its base element, and on a small portion of the sidewalk at the corner of Kilby and State Streets.

- 3:00 PM - As compared to existing conditions, the proposed building produces a new shadow on Broad Street.

ALTERNATIVE 2

- 9:00 AM - No new shadow.
- Noon - As compared to existing conditions, the proposed building casts a shadow on the roof of its base element, and on a small portion of the sidewalk at the corner of Kilby and State Streets.
- 3:00 PM - The proposed building casts a new shadow primarily on Broad Street and Central Street.

ALTERNATIVE 3

- 9:00 AM - No new shadow.
- Noon - As compared to existing conditions, the proposed building casts a shadow on the roof of its base element, and on a small portion of the sidewalk at the corner of Kilby and State Streets.
- 3:00 PM - The proposed building casts a new shadow primarily on Broad Street and Central Street.

December 21, Winter Solstice

ALTERNATIVE 1

- 9:00 AM - The proposed building casts a small new shadow on Congress Street adjacent to a large existing shadow.
- Noon - No new shadow.
- 3:00 PM - No new shadow.

ALTERNATIVE 2

- 9:00 AM - The proposed building produces an approximately 15 foot sliver of new shadow on Congress Street and the eastern-most portion of City Hall Plaza.
- Noon - No new shadow.

- 3:00 PM - No new shadow.

ALTERNATIVE 3

- 9:00 AM - The proposed building produces an approximately 15 foot sliver of new shadow on Congress Street and the eastern-most portion of City Hall Plaza which is otherwise completely in shadow now.

- Noon - No new shadow.

- 3:00 PM - No new shadow.

Exhibit IV D-1

Existing Conditions
June 21
9:00 am

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Existing Conditions
June 21
12:00 noon

Existing Shadow

New Shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Existing Conditions
June 21
3:00 pm

Existing Shadow

New Shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 1
June 21
9:00 am

Existing Shadow

New Shadow

No new shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 1
June 21
12:00 noon

Existing Shadow

New Shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 1
June 21
3:00 pm

Existing Shadow

New Shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 2
June 21
9:00 am

Existing Shadow

New Shadow

No new shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 2
June 21
12:00 noon

Existing Shadow

New Shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 2
June 21
3:00 pm

Existing Shadow

New Shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 3
June 21
9:00 am

Existing Shadow

New Shadow

No new shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 3
June 21
12:00 noon

Existing Shadow

New Shadow

Exhibit IV D-1

PROJECT AREA SHADOW CONDITIONS

Alternative 3
June 21
3:00 pm

Existing Shadow

New Shadow

JUGGLERS AREA

In addition to the traditional shadow analysis outlined above, the proponent undertook a detailed shadow analysis for the "Jugglers Area" between Faneuil Hall and the central Quincy Market Building. The study examined this area on October 21 and November 21 at 10:00 AM, 11:00 AM, Noon, 1:00 PM and 2:00 PM. These dates and times were chosen because previous studies suggested that project-generated shadows might fall on this area only during these periods. For periods during which any amount of shadow is cast on the "Jugglers Area," shadow studies were also prepared in fifteen-minute increments in order to more clearly depict the movement and duration of such shadows (fifteen-minute studies available from Skidmore, Owings & Merrill). The analysis addresses shadows cast on the ground plane by buildings in the project area and the incremental shadows cast by the 99 State Street Project. Shadow impacts which occur in October and November can also be expected to occur in April and May, respectively.

October 21 (see Exhibit IV D-2)

ALTERNATIVE 1

- 10:00 AM - No new shadow.
- 11:00 AM - No new shadow.
- Noon - No new shadow.
- 1:00 PM - No new shadow.
- 2:00 PM - No new shadow.

ALTERNATIVE 2

- 10:00 AM - No new shadow in "Jugglers Area". The proposed building casts a small sliver of shadow to the south of the "Jugglers Area."
- 11:00 AM - No new shadow in "Jugglers Area". The proposed building produces a new shadow to the south of the "Jugglers Area". The shadow is gone by 11:15 AM.
- Noon - No new shadow.

- 1:00 PM - No new shadow.
- 2:00 PM - No new shadow.

ALTERNATIVE 3

- 10:00 AM - No new shadow in "Jugglers Area". The proposed building casts a small shadow by the plaza at the southeast corner of Faneuil Hall. The shadow moves through the area during the period from 10:00 AM to 11:45 AM.
- 11:00 AM - The proposed building produces a new shadow to the south of the "Jugglers Area". The shadow is largely gone by 11:30 AM, and completely gone by 11:45 AM.
- Noon - No new shadow.
- 1:00 PM - No new shadow.
- 2:00 PM - No new shadow.

November 21 (see Exhibit IV D-2)

ALTERNATIVE 1

- 10:00 AM - No new shadow in "Jugglers Area". The proposed building produces a small sliver of shadow to the south of the "Jugglers Area." This area of shadow is gone by 10:30 AM.
- 11:00 AM - No new shadow.
- Noon - No new shadow.
- 1:00 PM - No new shadow.
- 2:00 PM - No new shadow.

ALTERNATIVE 2

- 10:00 AM - As compared to existing conditions, the proposed building adds a small sliver of shadow southeast of Faneuil Hall. This area of shadow increases until 10:45 AM, when it begins to subside.

- 11:00 AM - The proposed building produces a new shadow north of the central "Jugglers Area", at a time when existing structures already cause this area to be largely in shadow. The new shadow is largely gone by 11:30 AM, and completely gone by noon.

- Noon - No new shadow.

- 1:00 PM - No new shadow.

- 2:00 PM - No new shadow.

ALTERNATIVE 3

- 10:00 AM - As compared to existing conditions, the proposed building adds a small sliver of shadow southeast of Faneuil Hall. This area of shadow increases until 10:45 AM, when it begins to subside.

- 11:00 AM - The proposed building produces a new shadow north of the central "Jugglers Area", at a time when existing structures already cause this area to be largely in shadow. The new shadow is largely gone by 11:30 AM, and completely gone by noon.

- Noon - No new shadow.

- 1:00 PM - No new shadow.

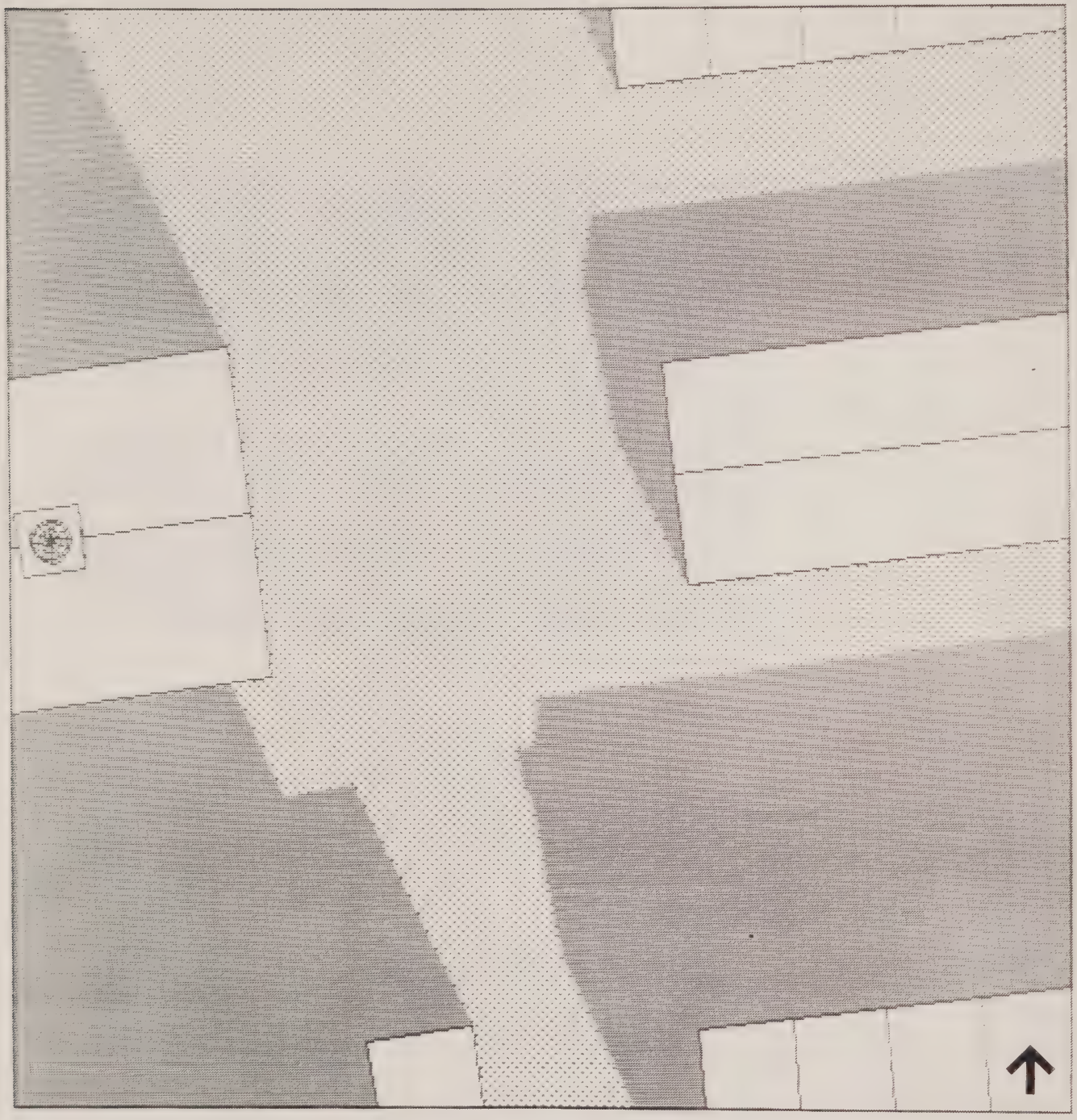
- 2:00 PM - No new shadow.

CONCLUSIONS

Shadow analysis indicates that, for the most part, the development alternatives result in no significant additional shadow in the vicinity of the project. During limited periods at various points in the project area, all three development alternatives were found to add only extremely small areas of increased shadow This minimal impact is due, in part, to the removal of the 184-foot 89 State Street building, and the set-back position of the project's tower element.

Shadow analysis of the "Jugglers Area" did indicate that during late Fall (and early Spring), some incremental shadow effects occur for a very limited period during morning hours as a result of the project. Little difference occurs between the effect of Alternative 2 and Alternative 3 in this area. No new shadows are created in this area by any of the development alternatives during lunchtime peak use periods.

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
October 21
10:00 am

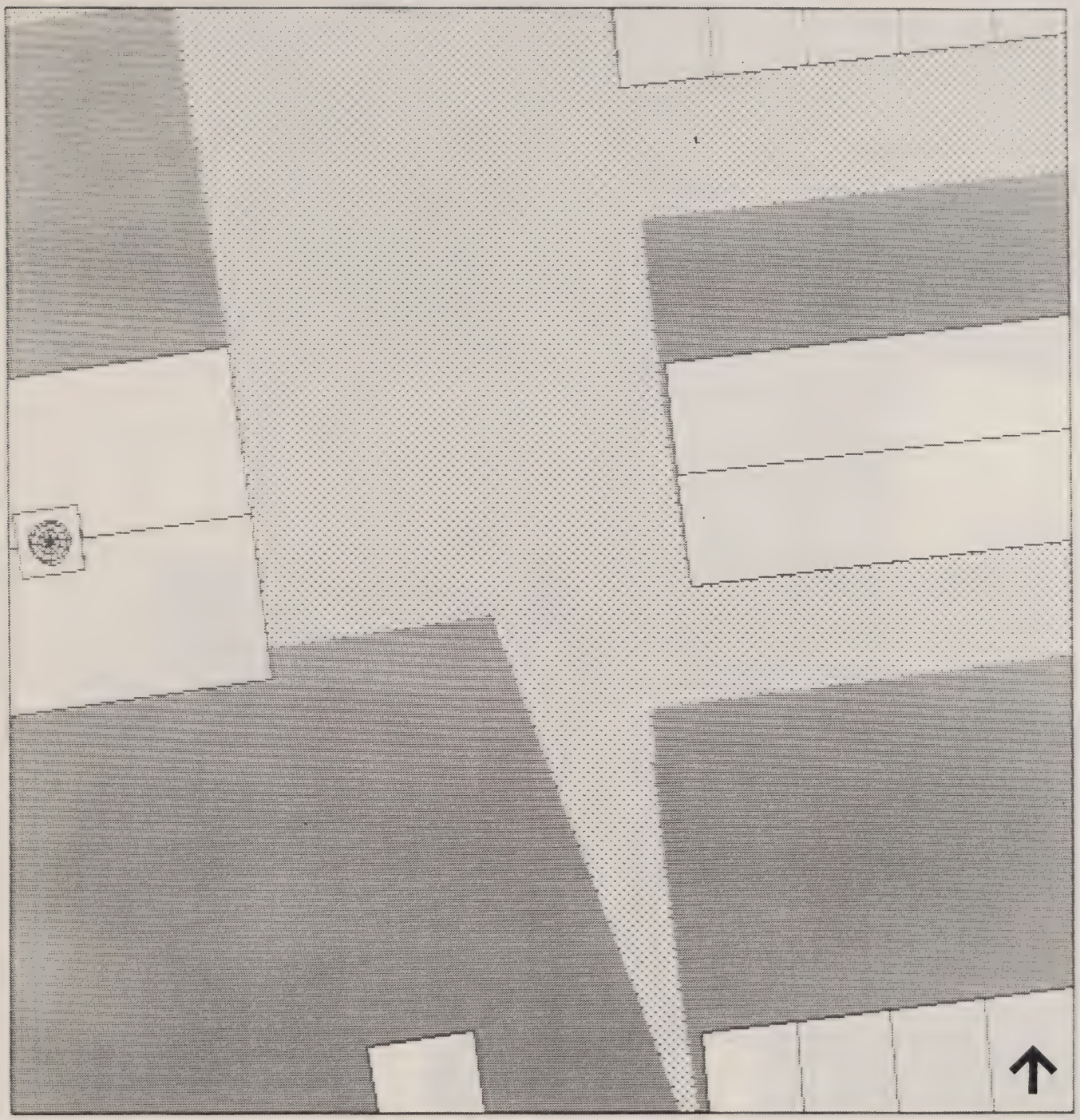
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
October 21
11:00 am

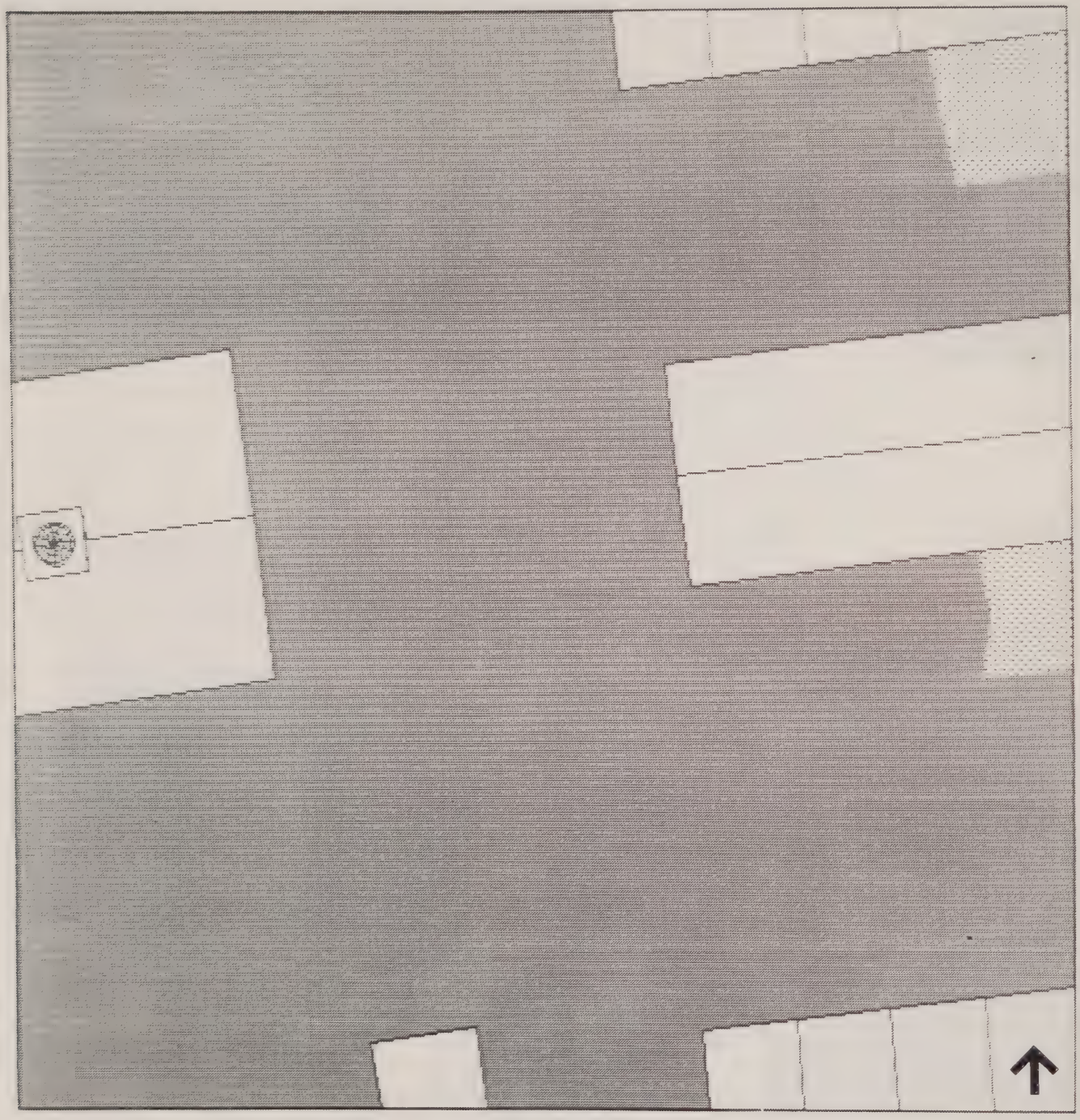
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
October 21
12:00 noon

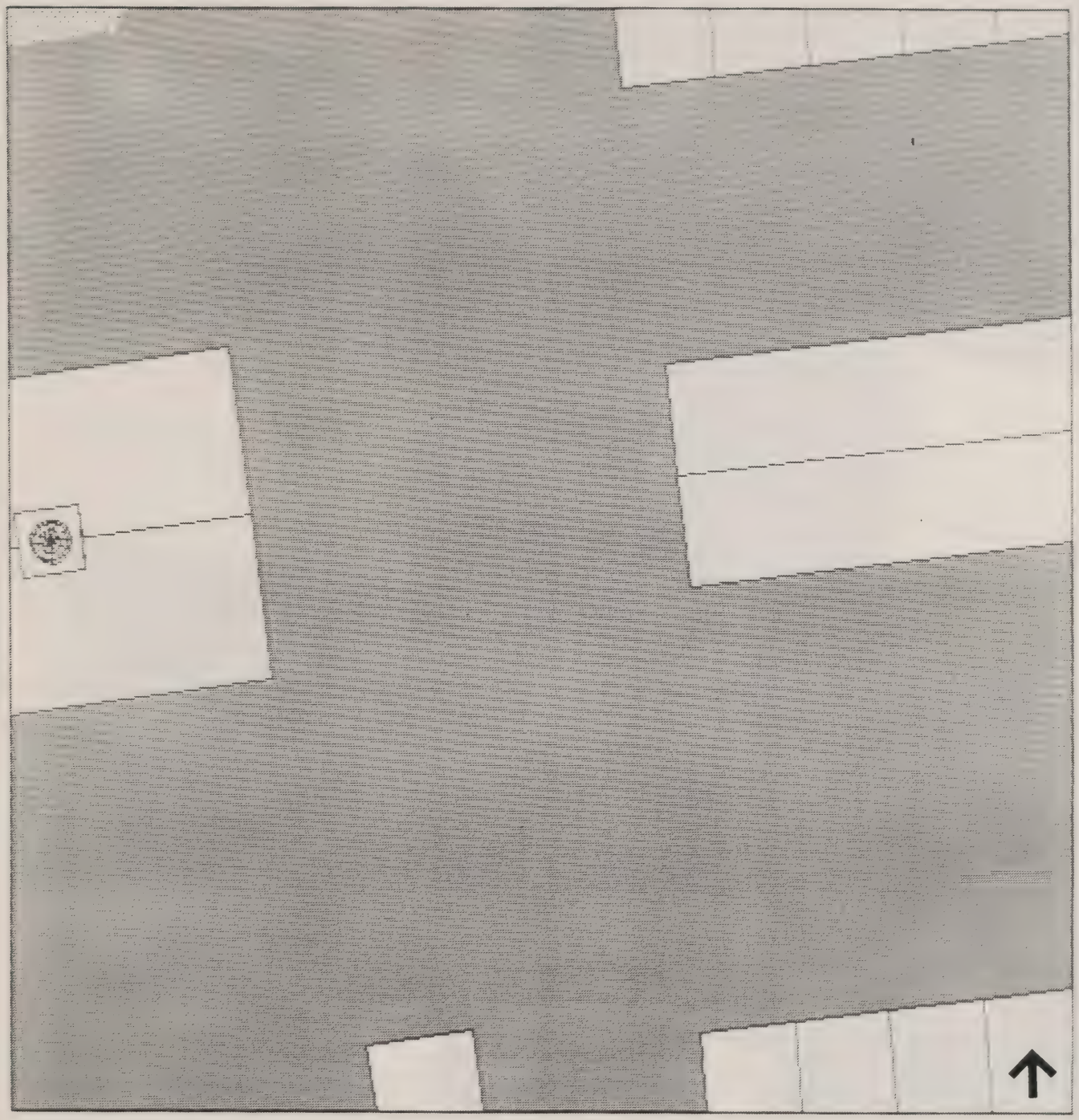
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
October 21
1:00 pm

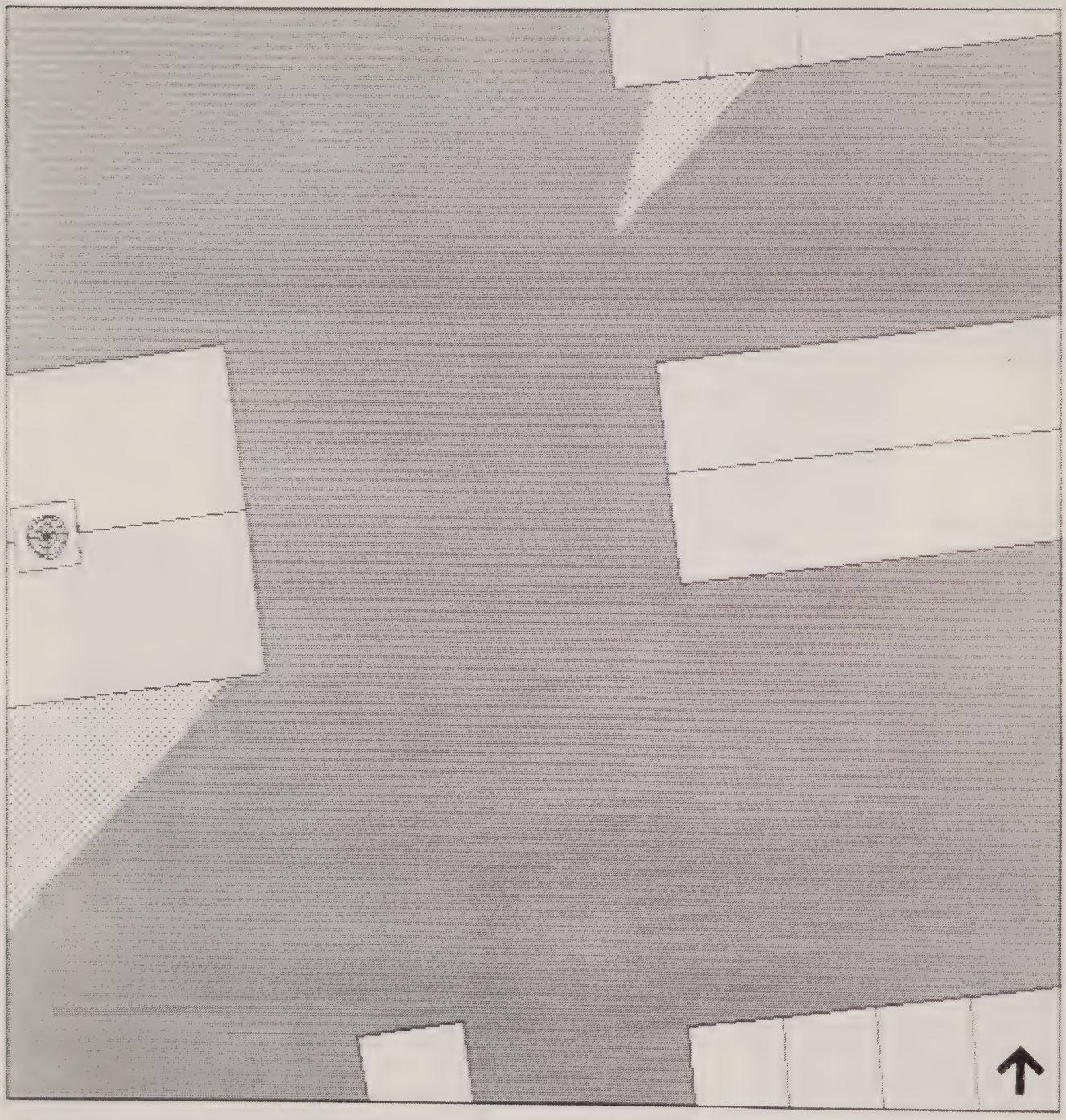
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
October 21
2:00 pm

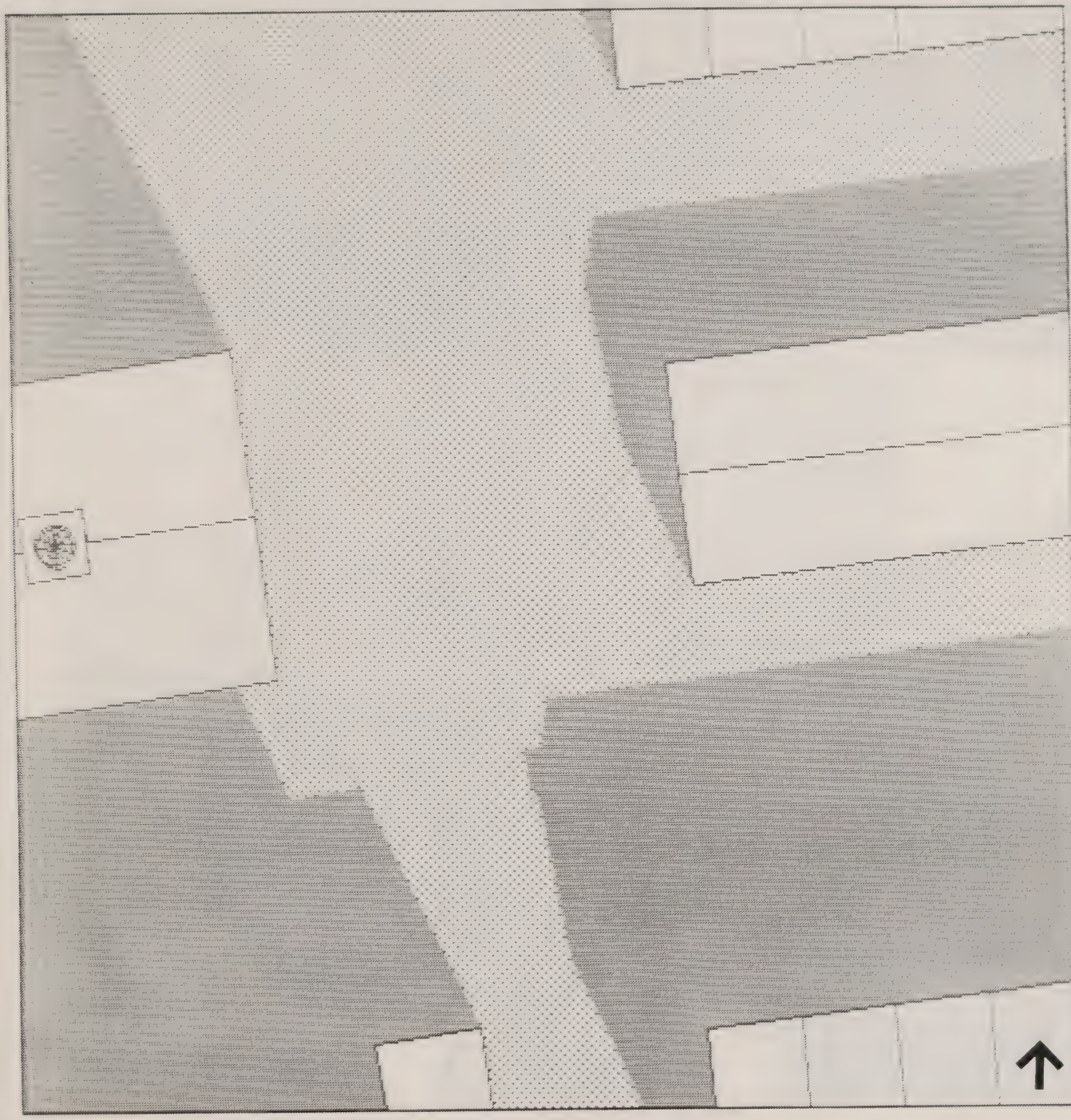
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
October 21
10:00 am

No new shadow

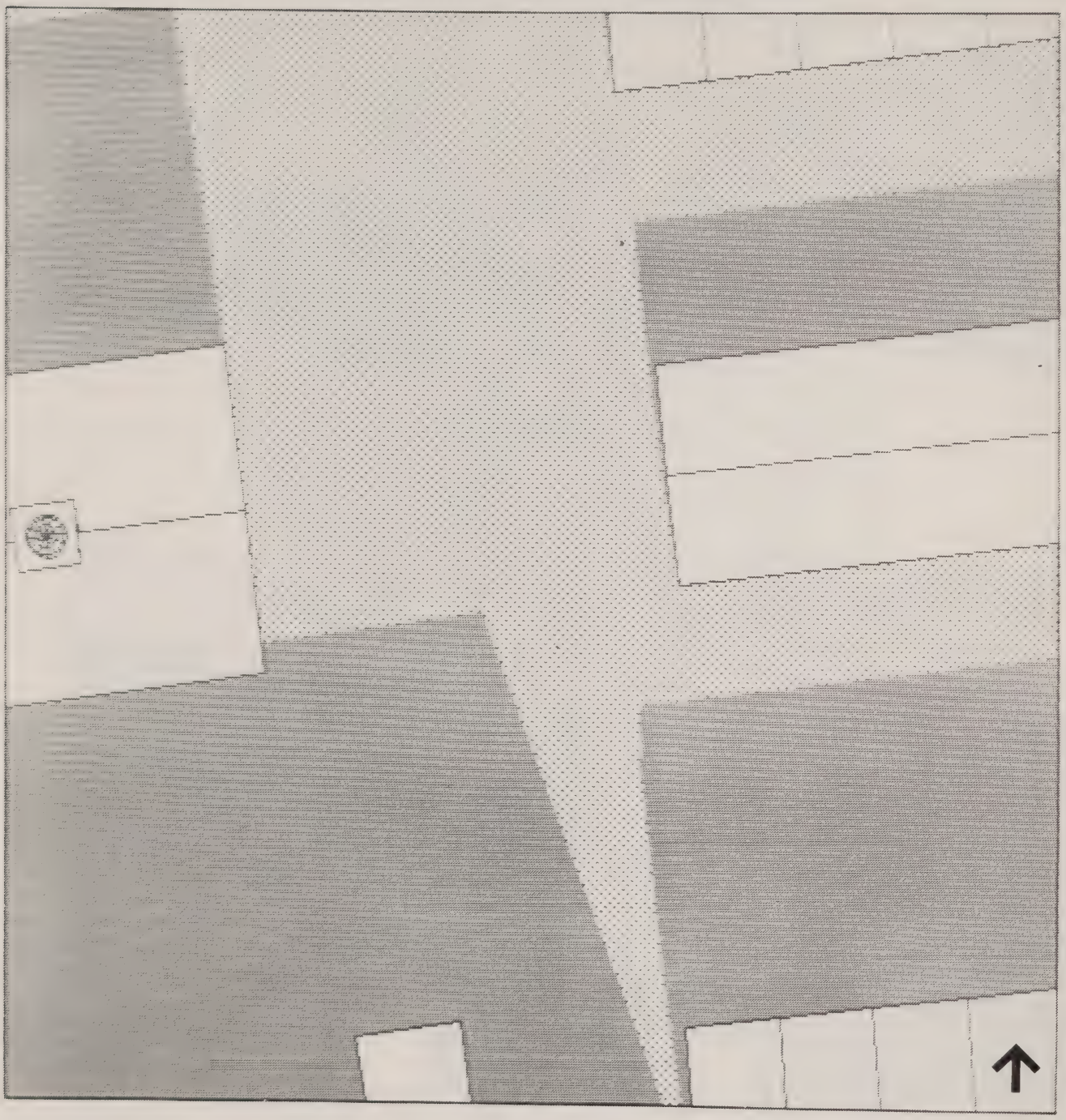
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
October 21
11:00 am

No new shadow

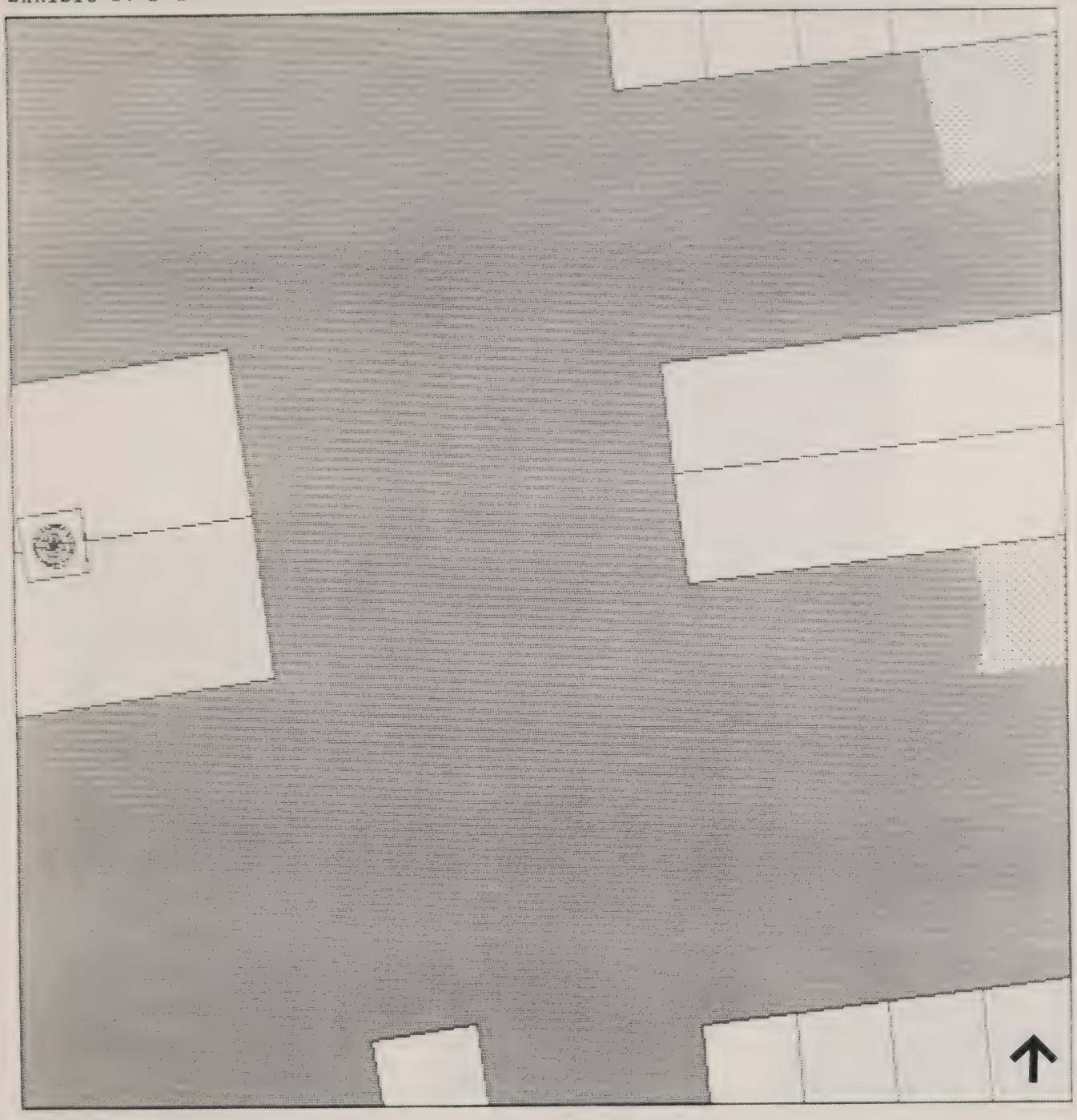
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
October 21
12:00 noon

No new shadow

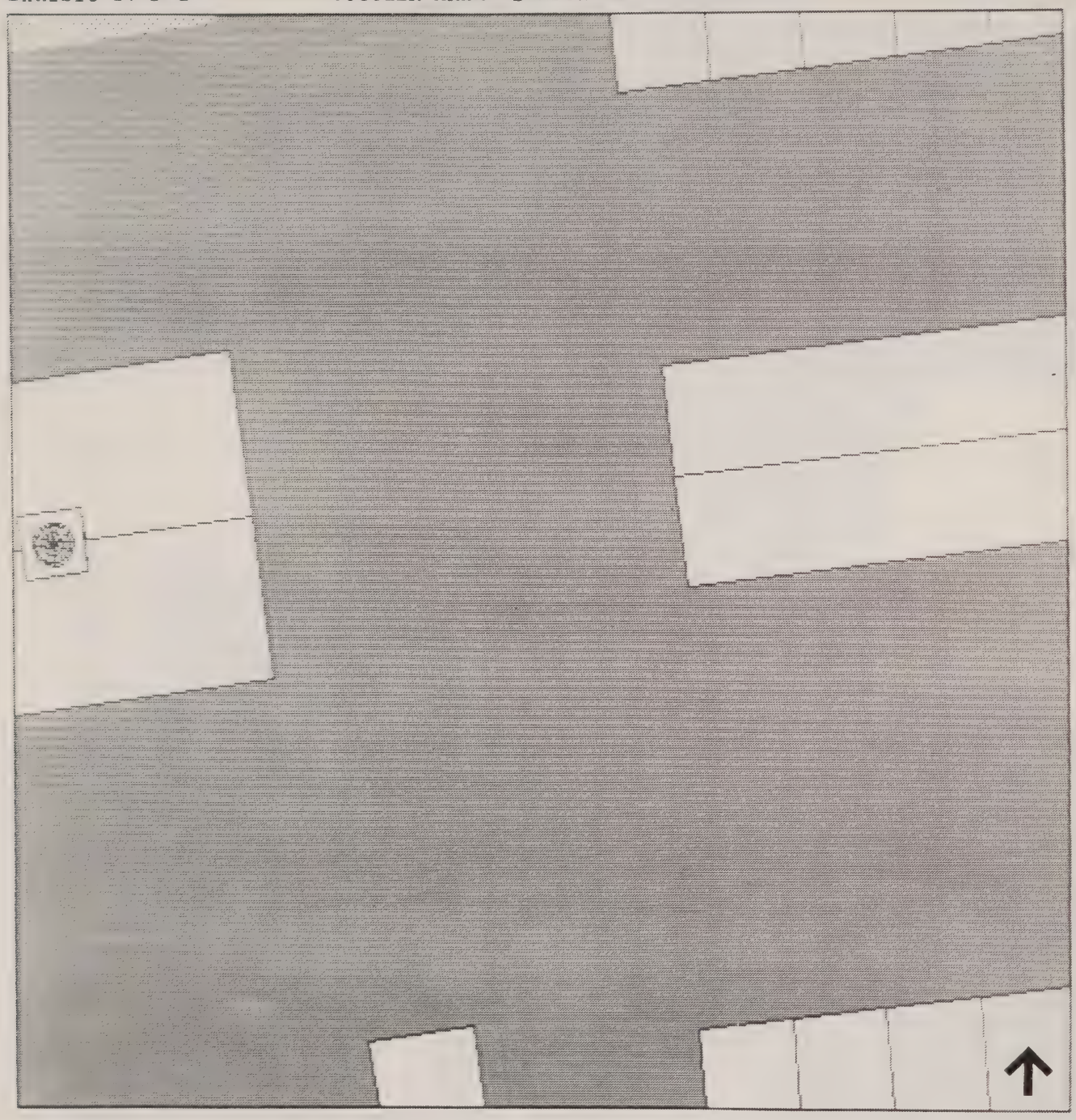
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
October 21
1:00 pm

No new shadow

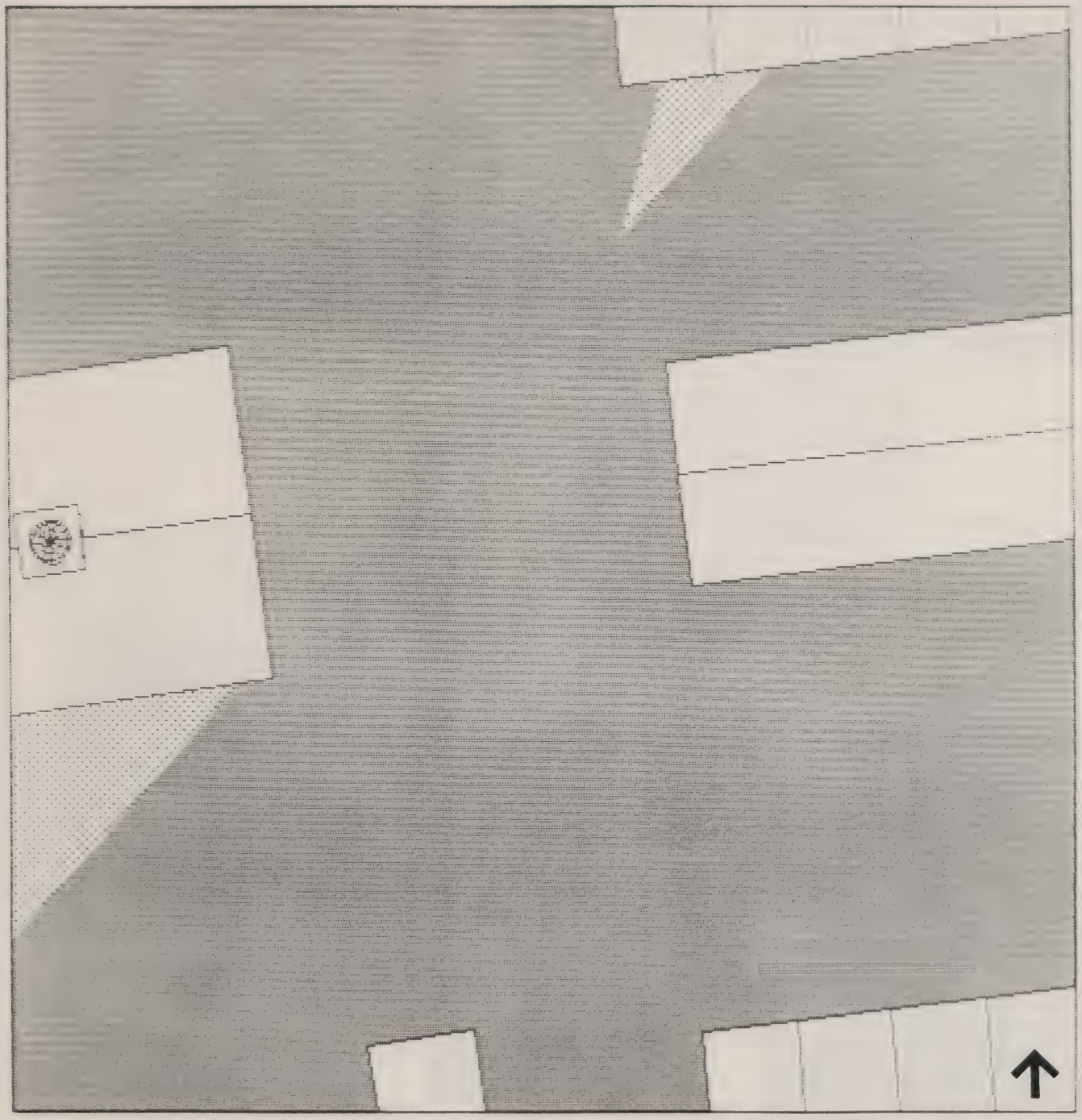
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
October 21
2:00 pm

No new shadow

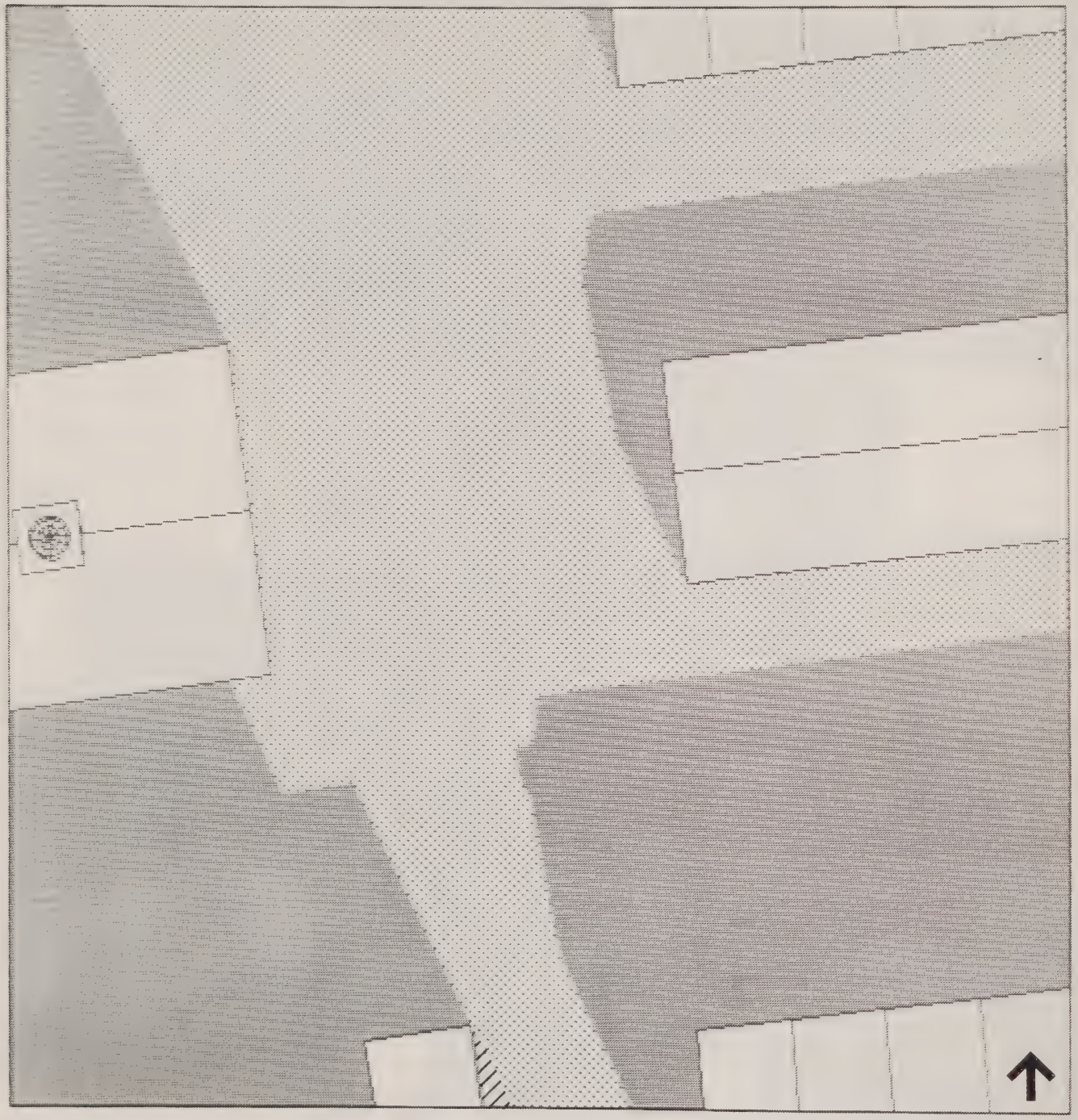
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
October 21
10:00 am

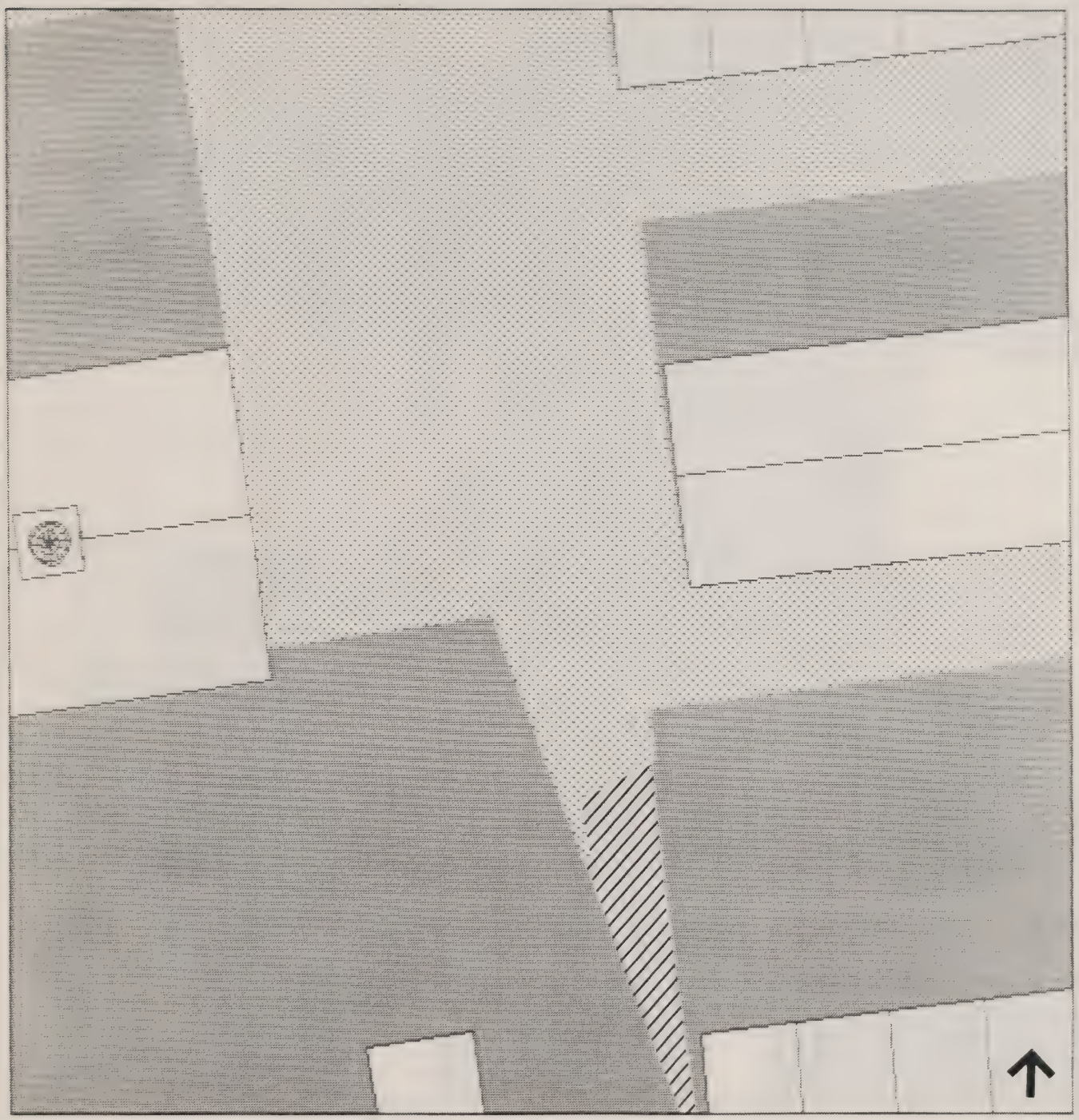
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
October 21
11:00 am

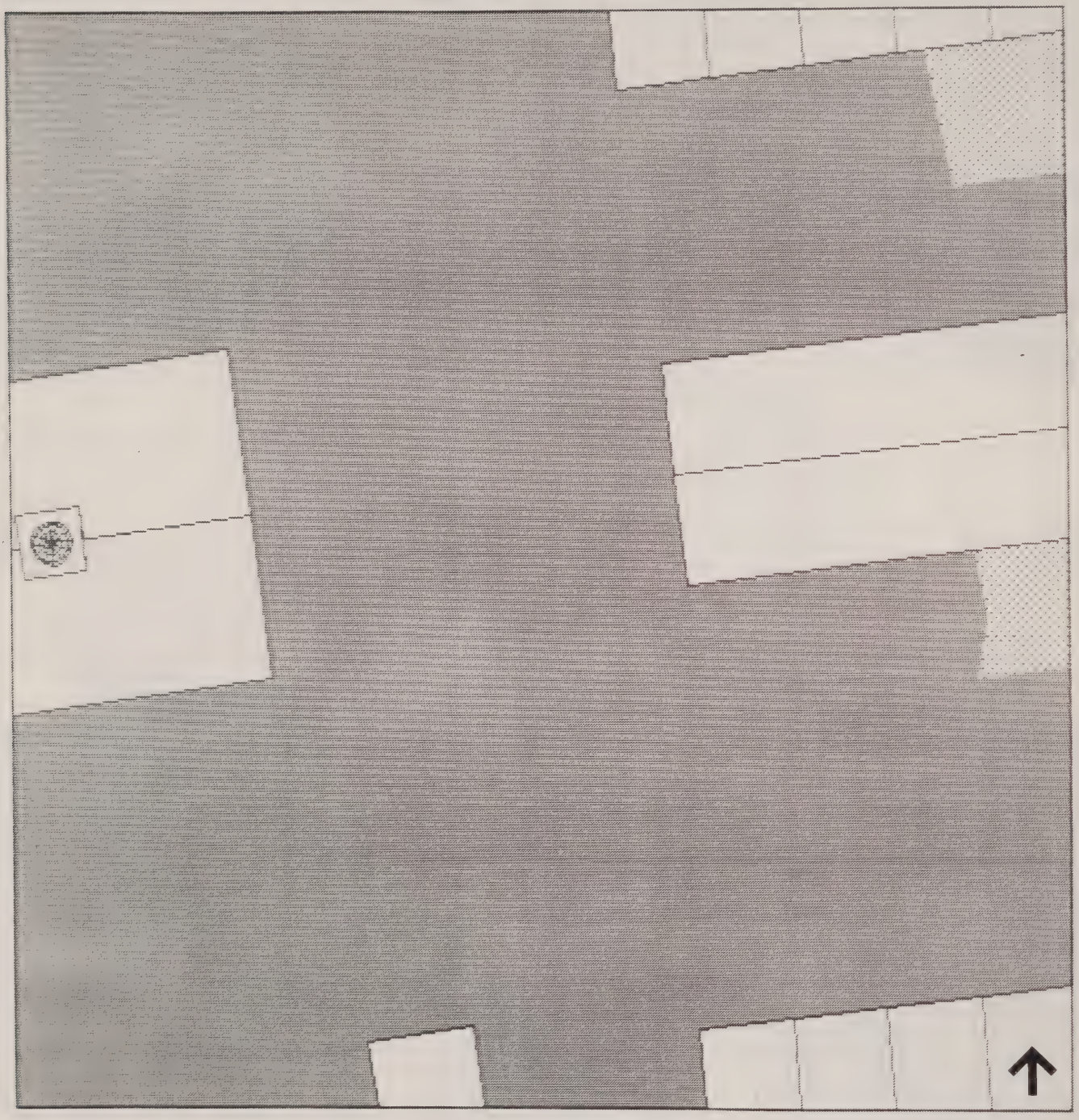
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
October 21
12:00 noon

No new shadow

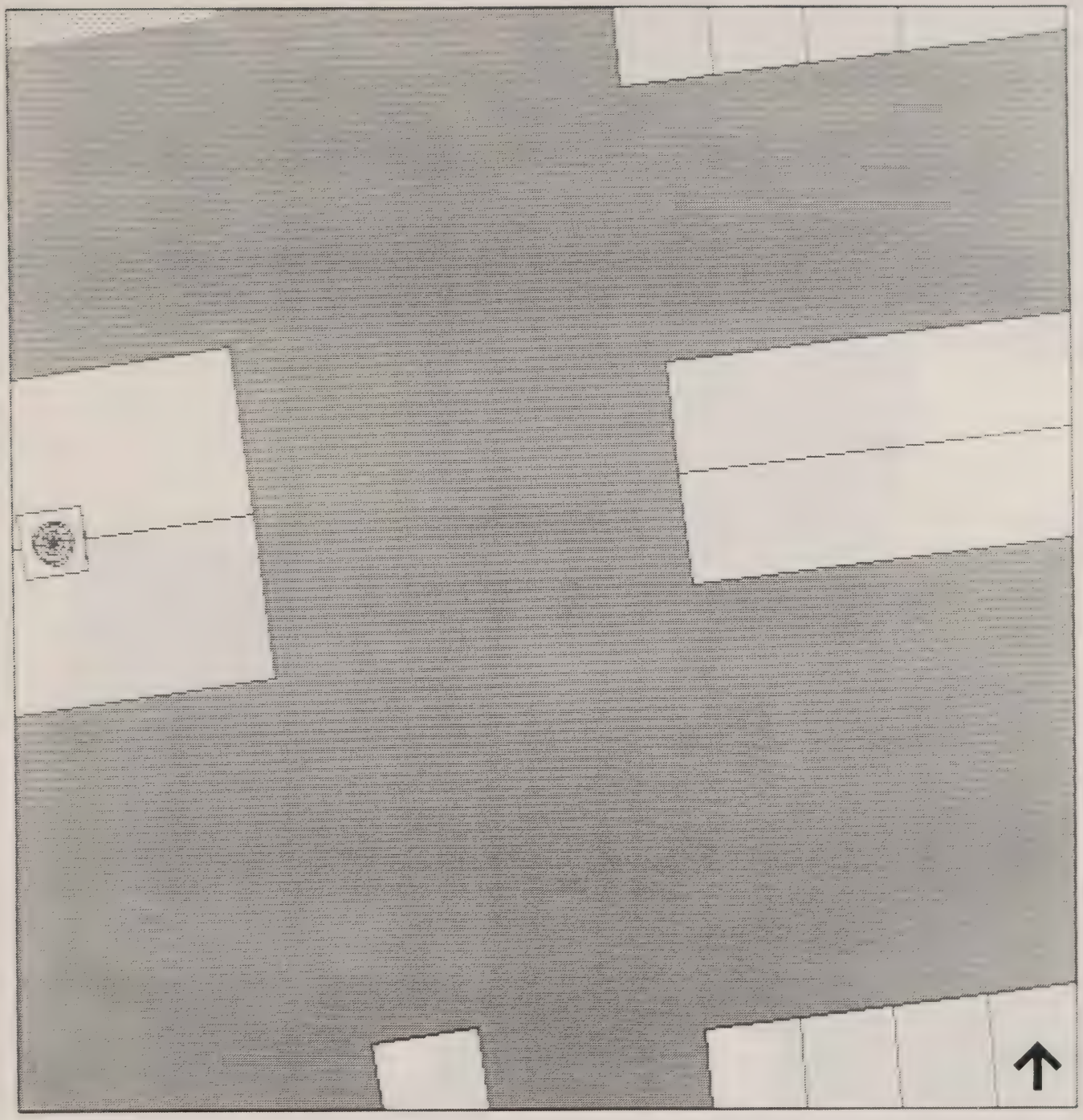
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
October 21
1:00 pm

No new shadow

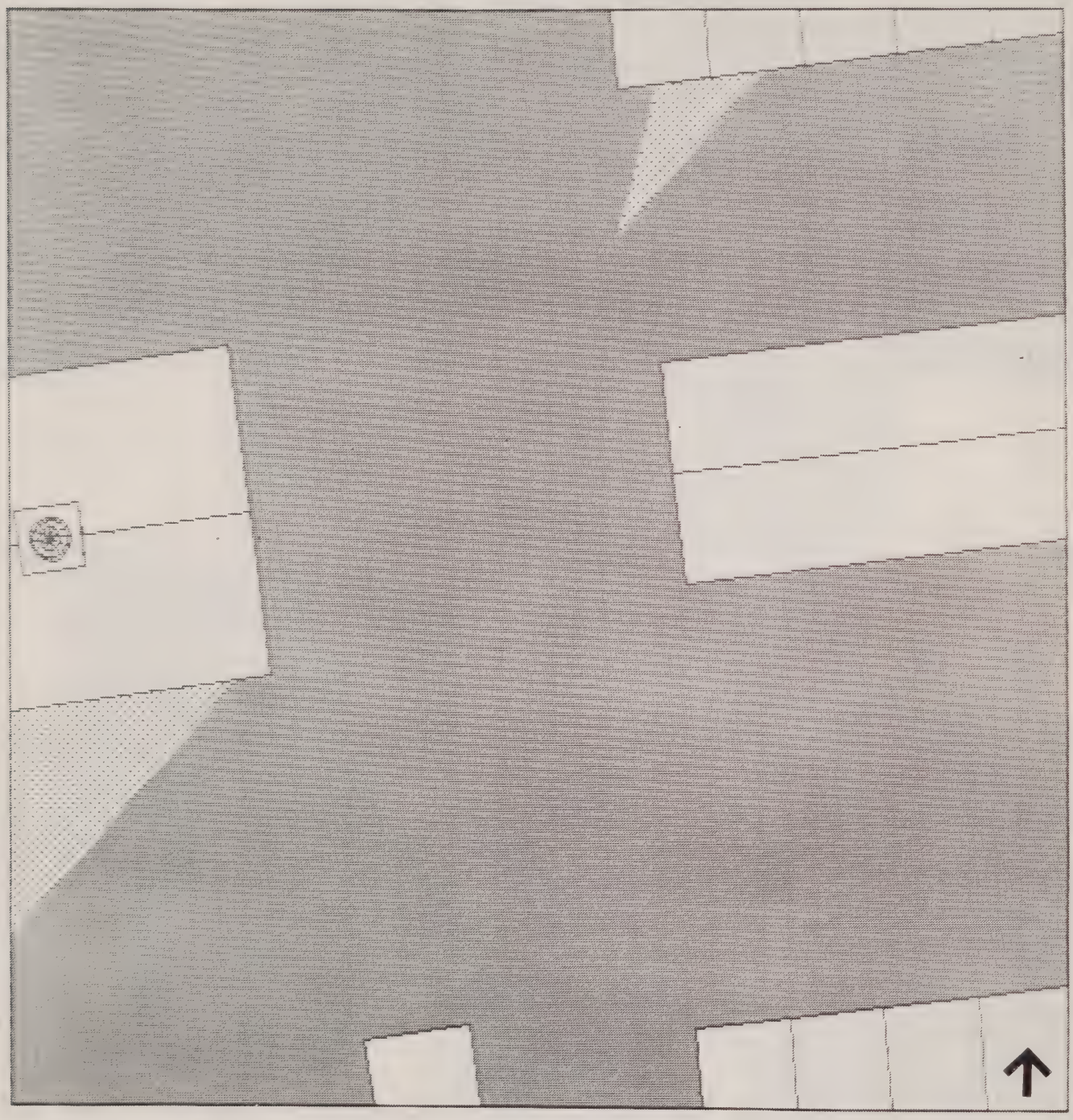
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
October 21
2:00 pm

No new shadow

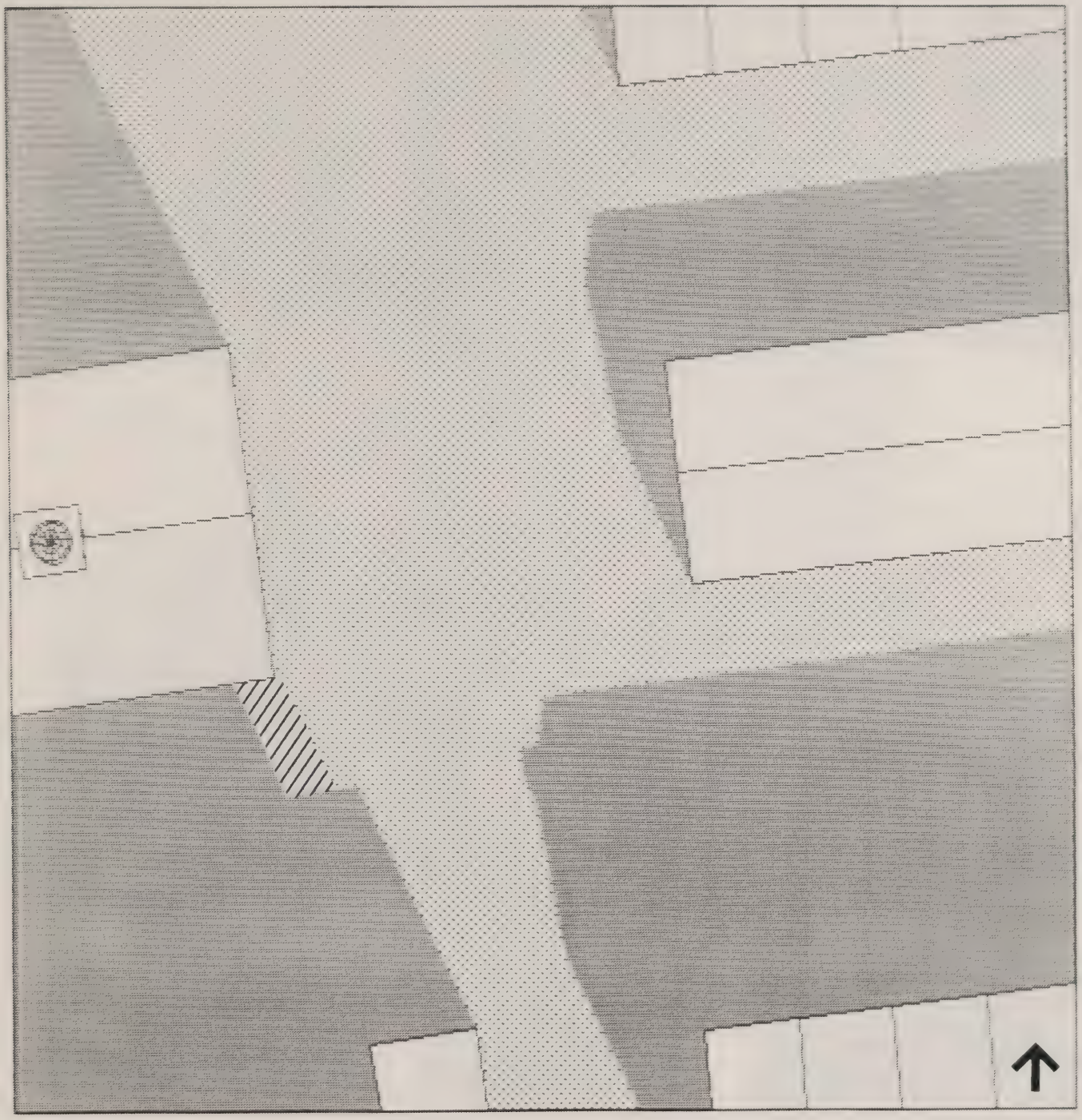
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
October 21
10:00 am

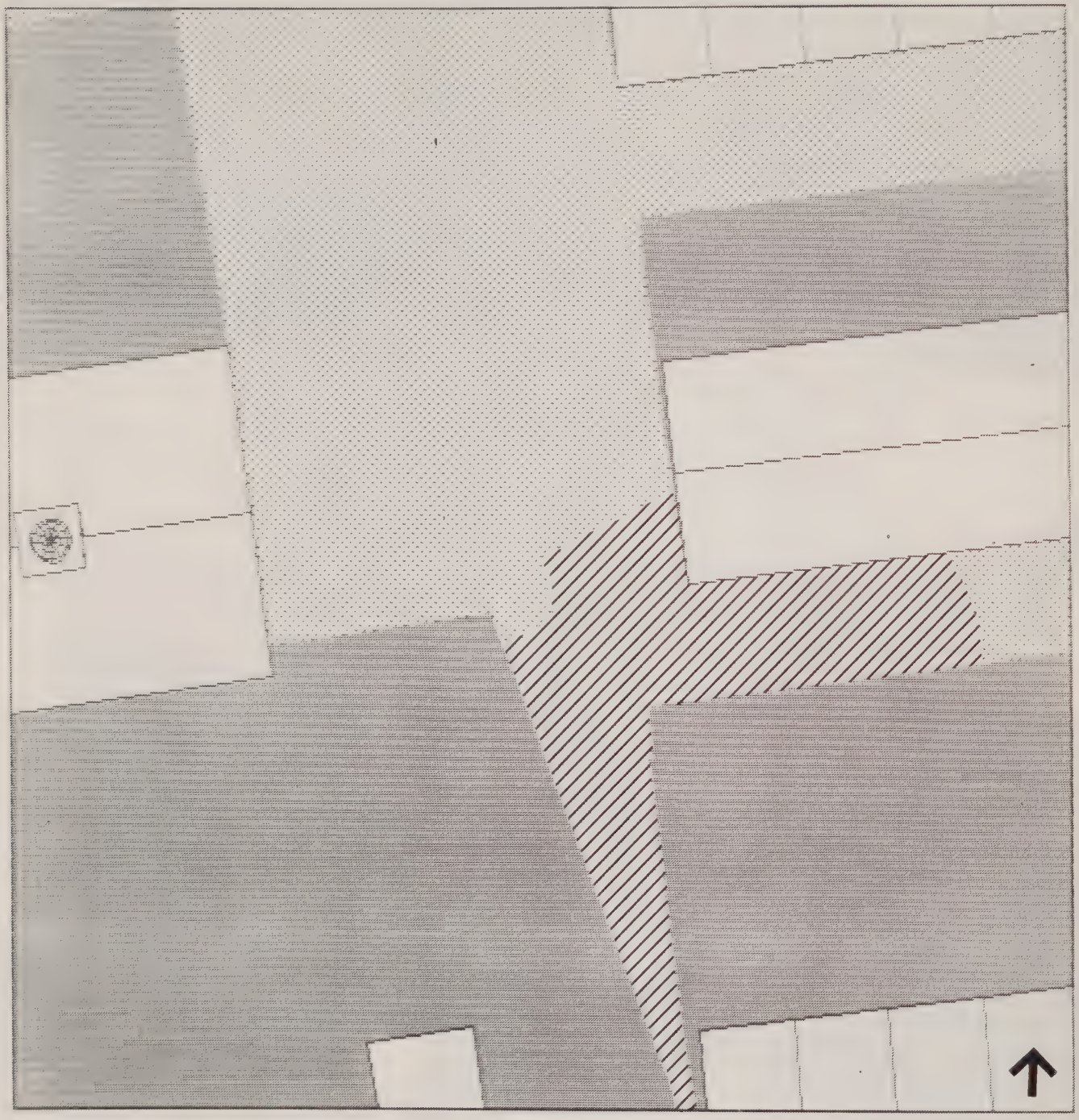
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
October 21
11:00 am

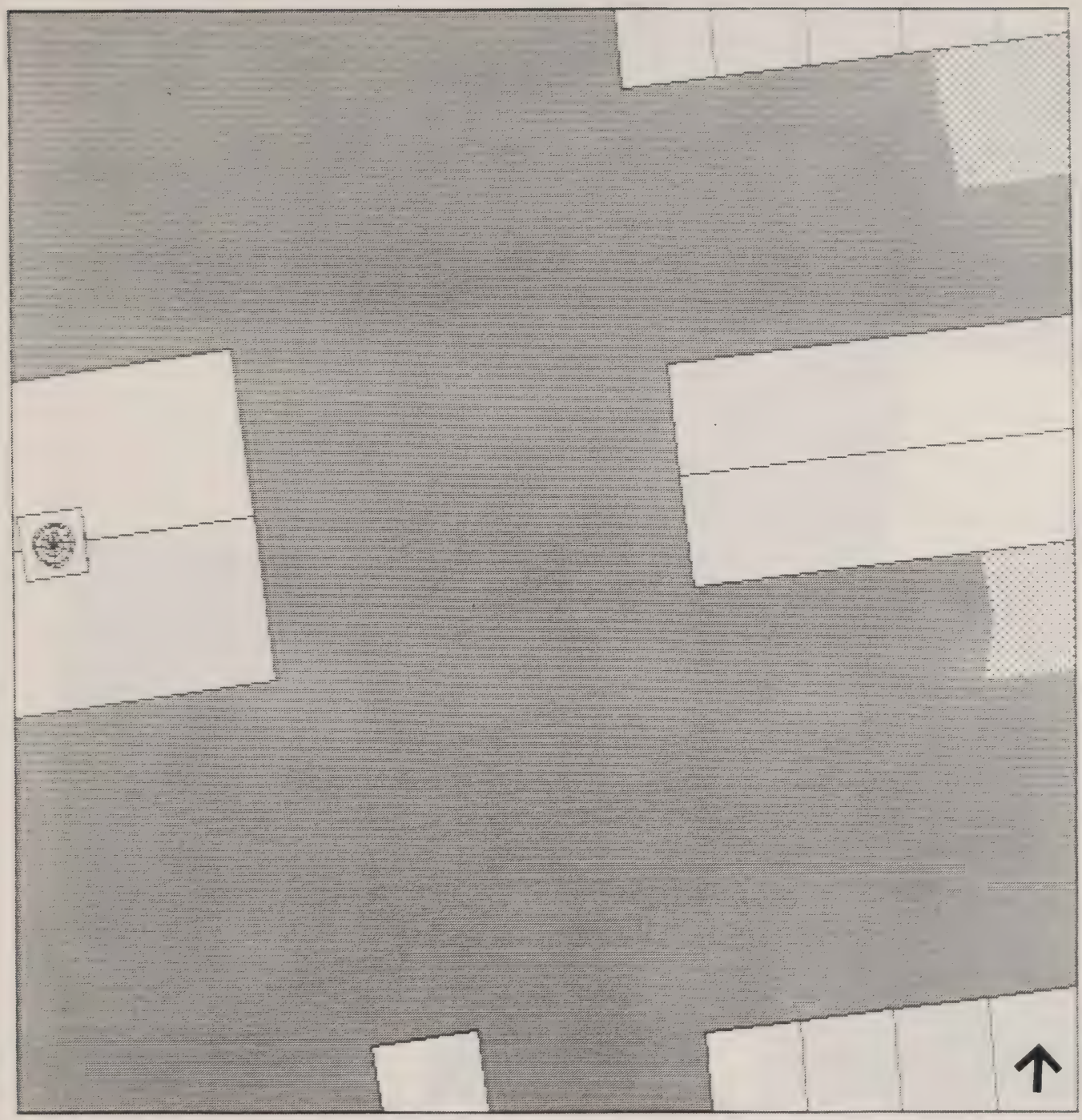
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
October 21
12:00 noon

No new shadow

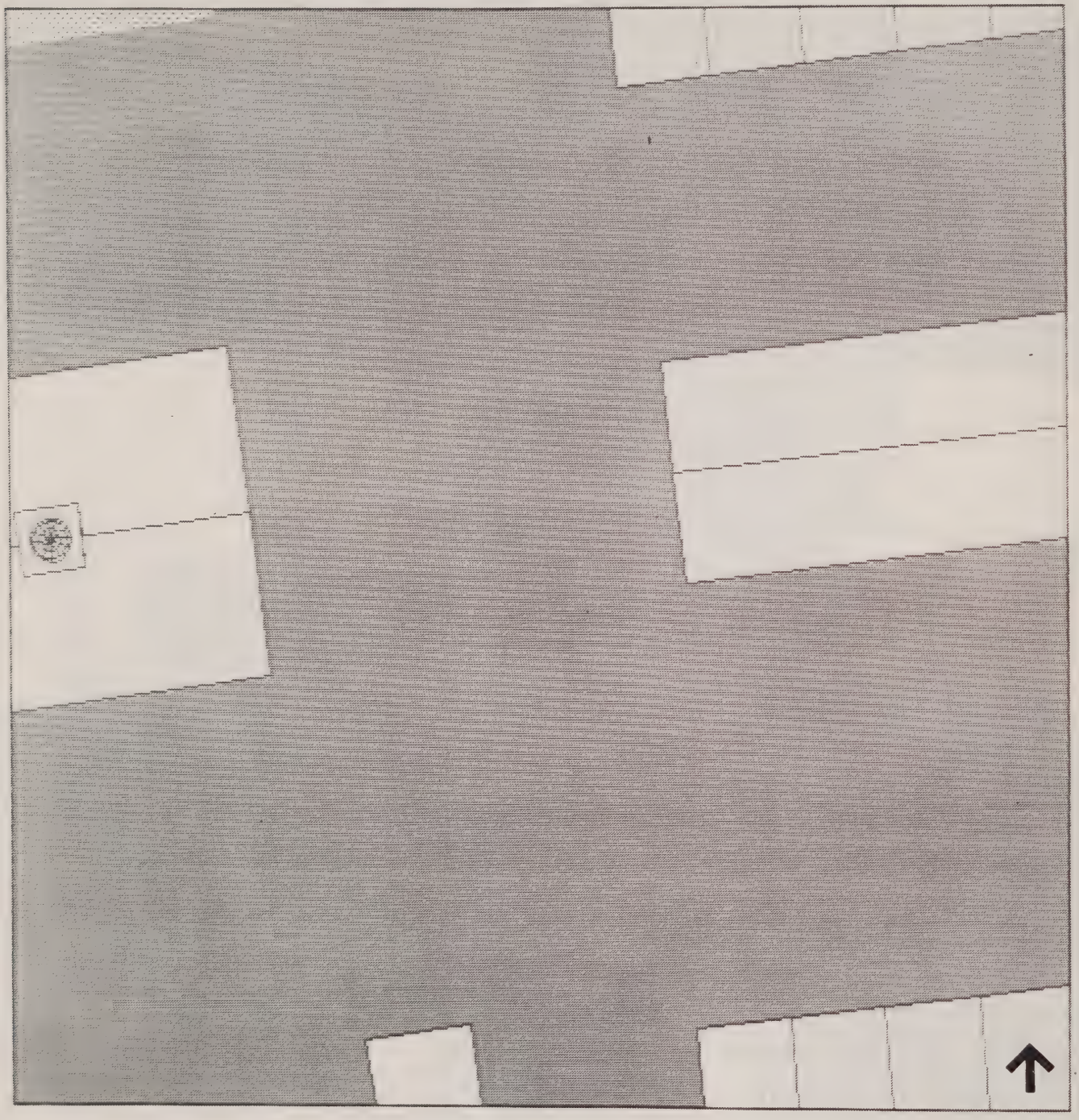
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
October 21
1:00 pm

No new shadow

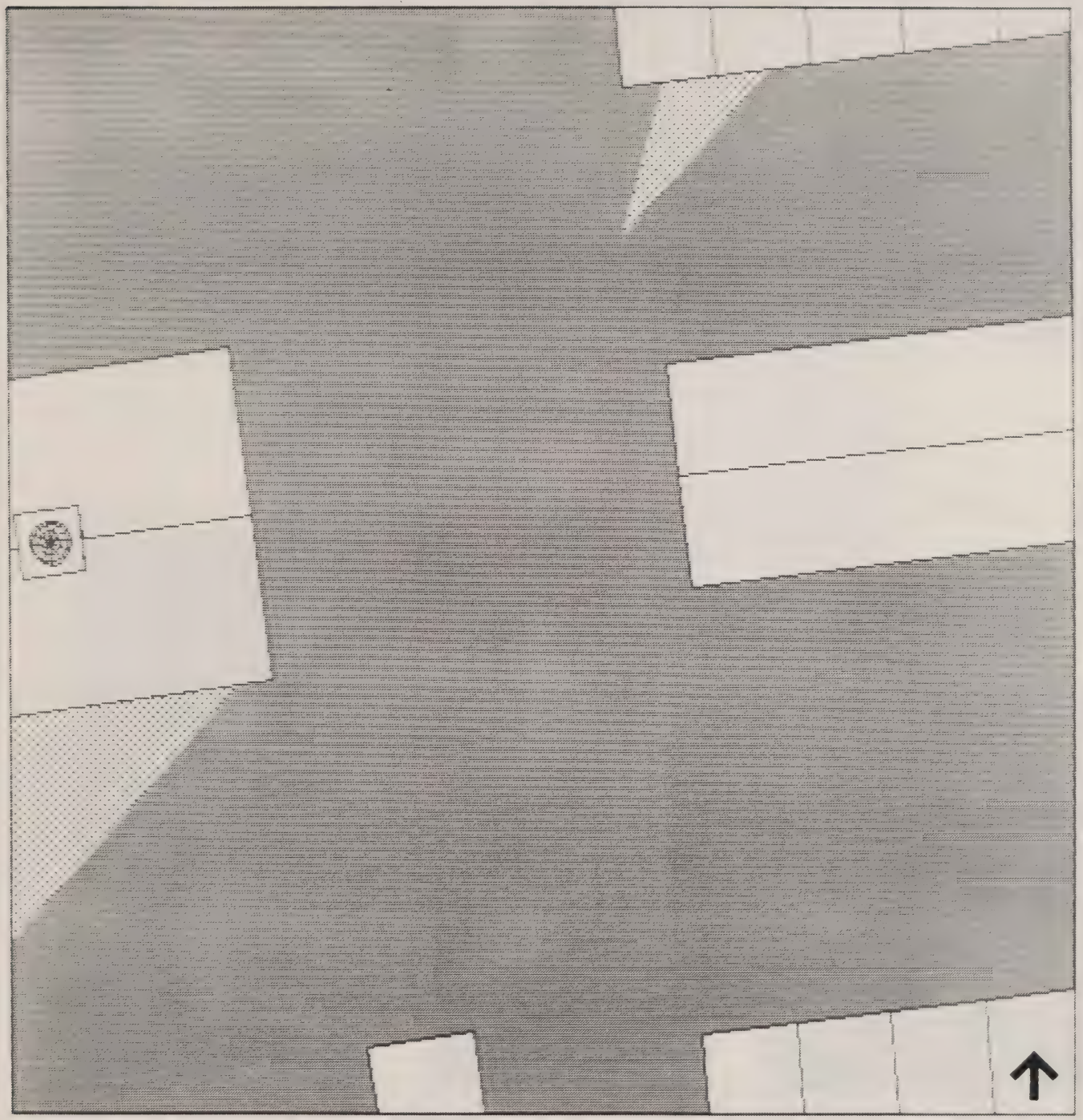
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
October 21
2:00 pm

No new shadow

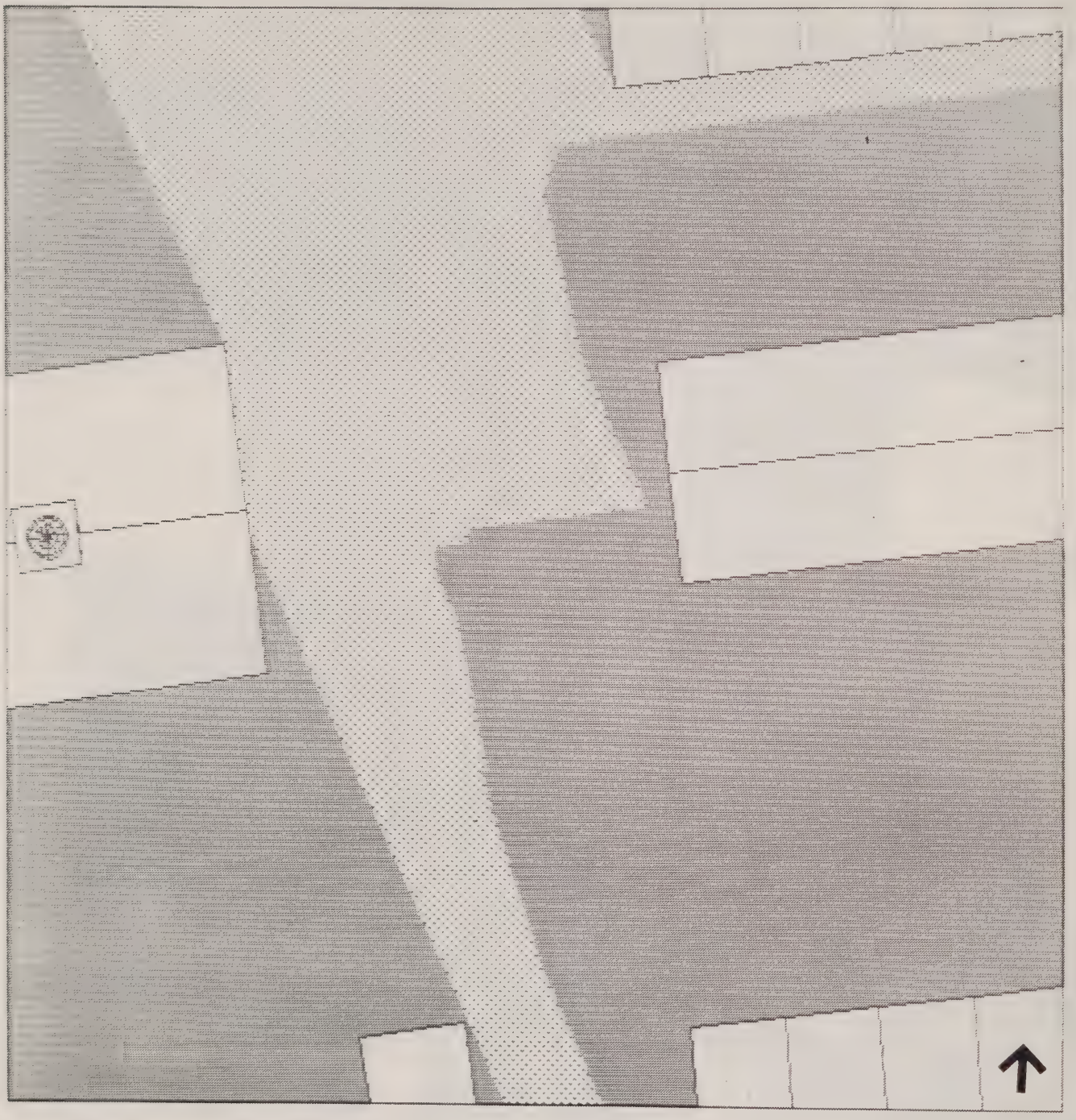
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
November 21
10:00 am

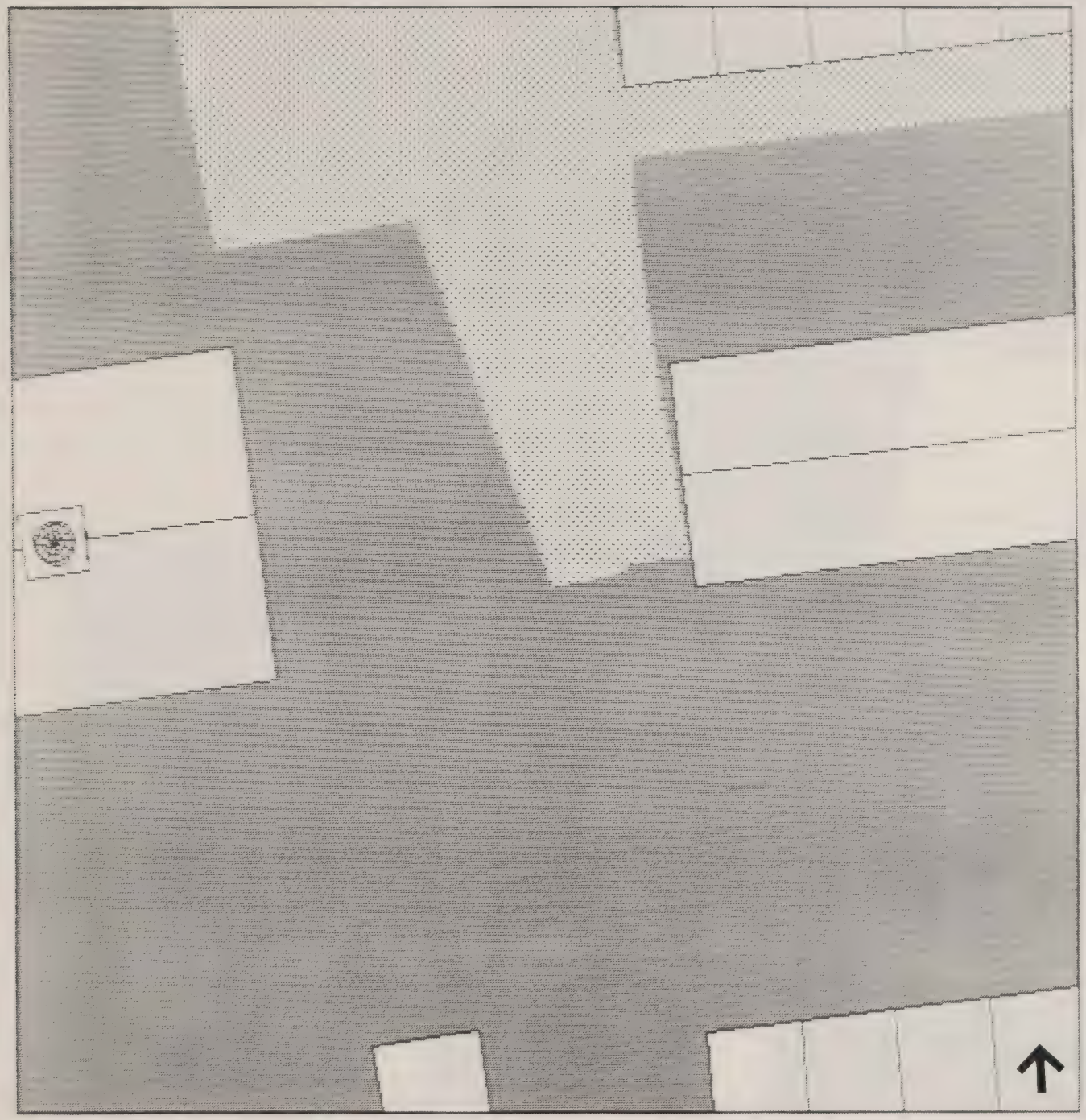
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
November 21
11:00 am

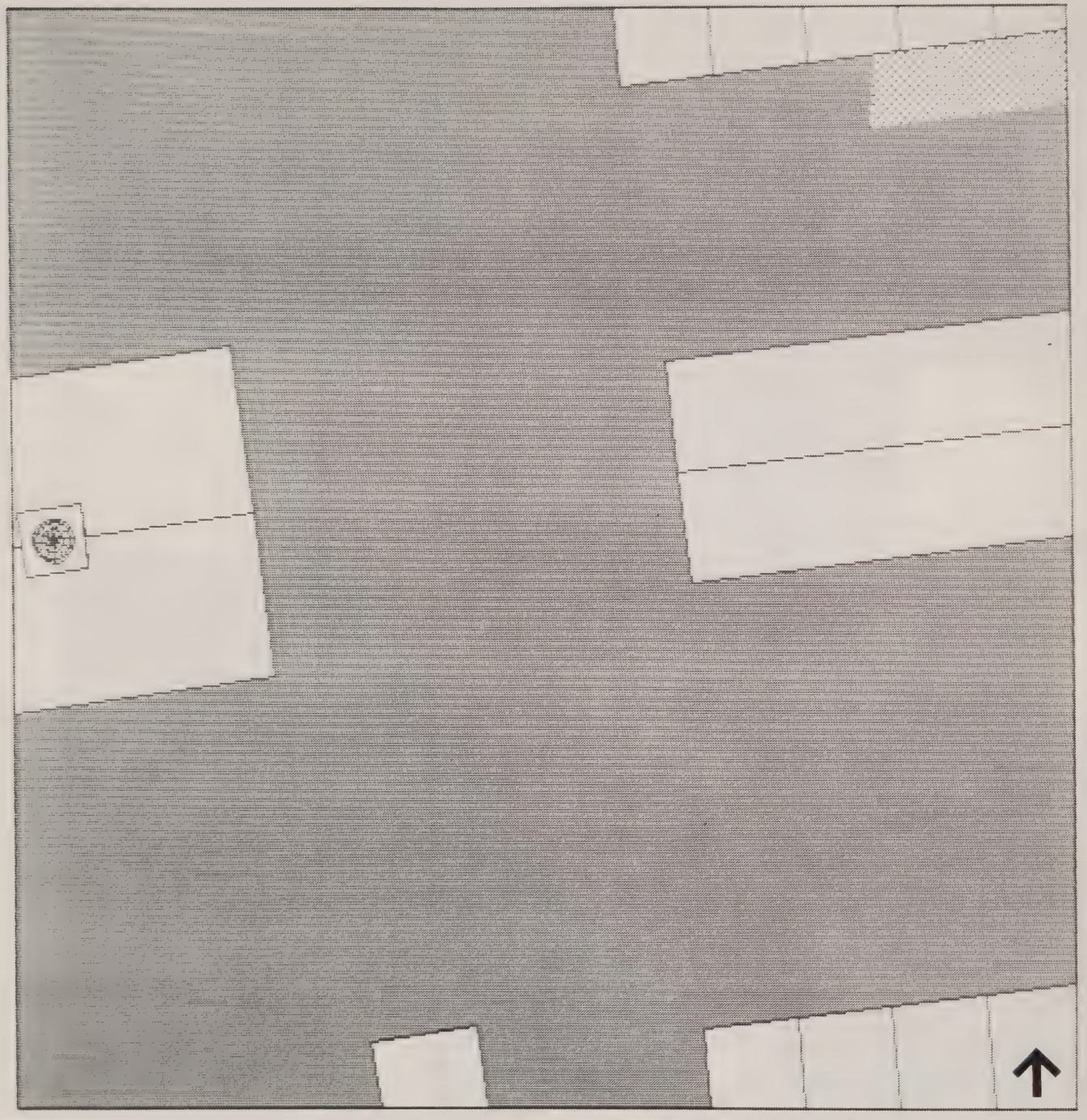
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
November 21
12:00 noon

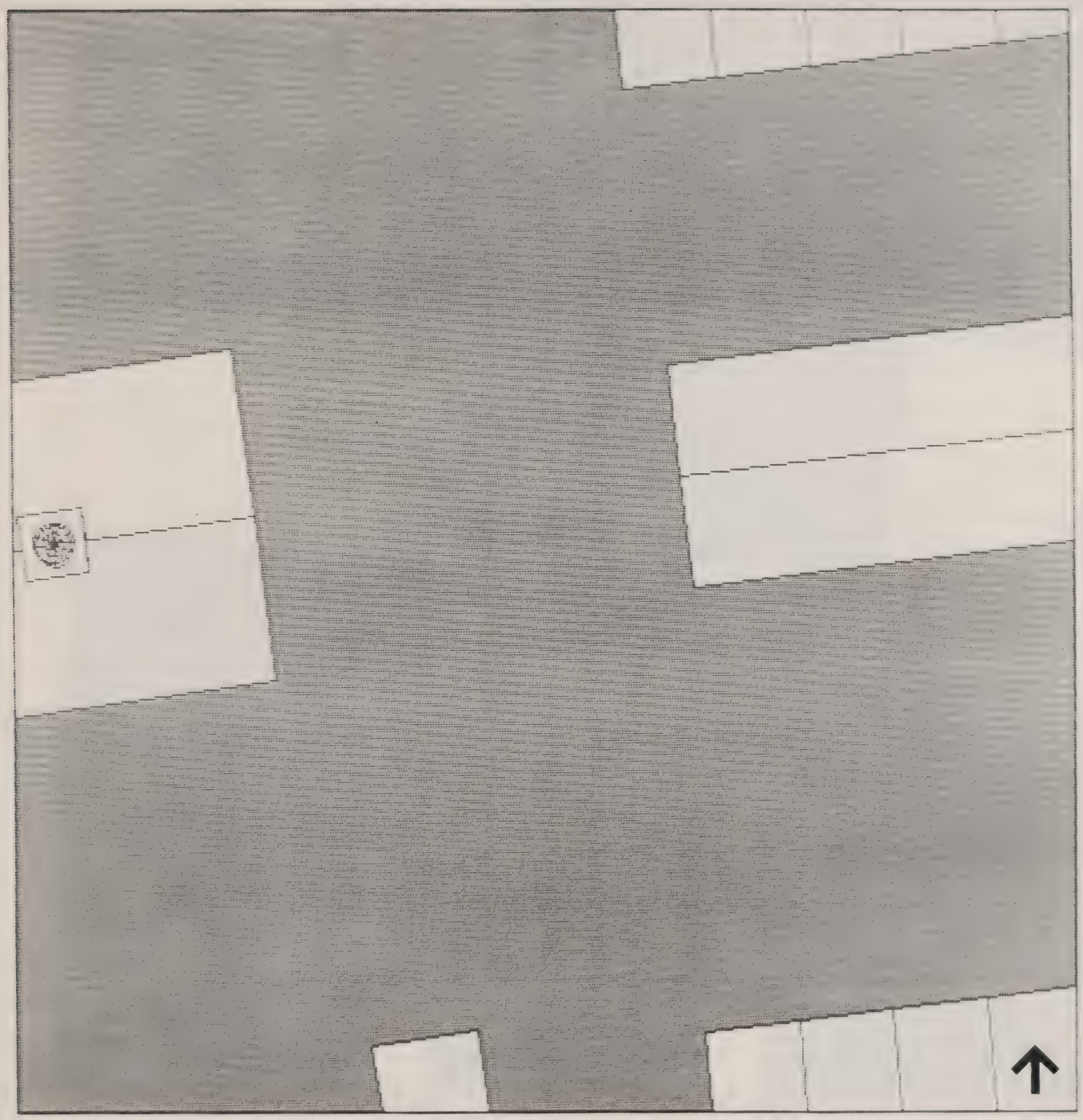
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
November 21
1:00 pm

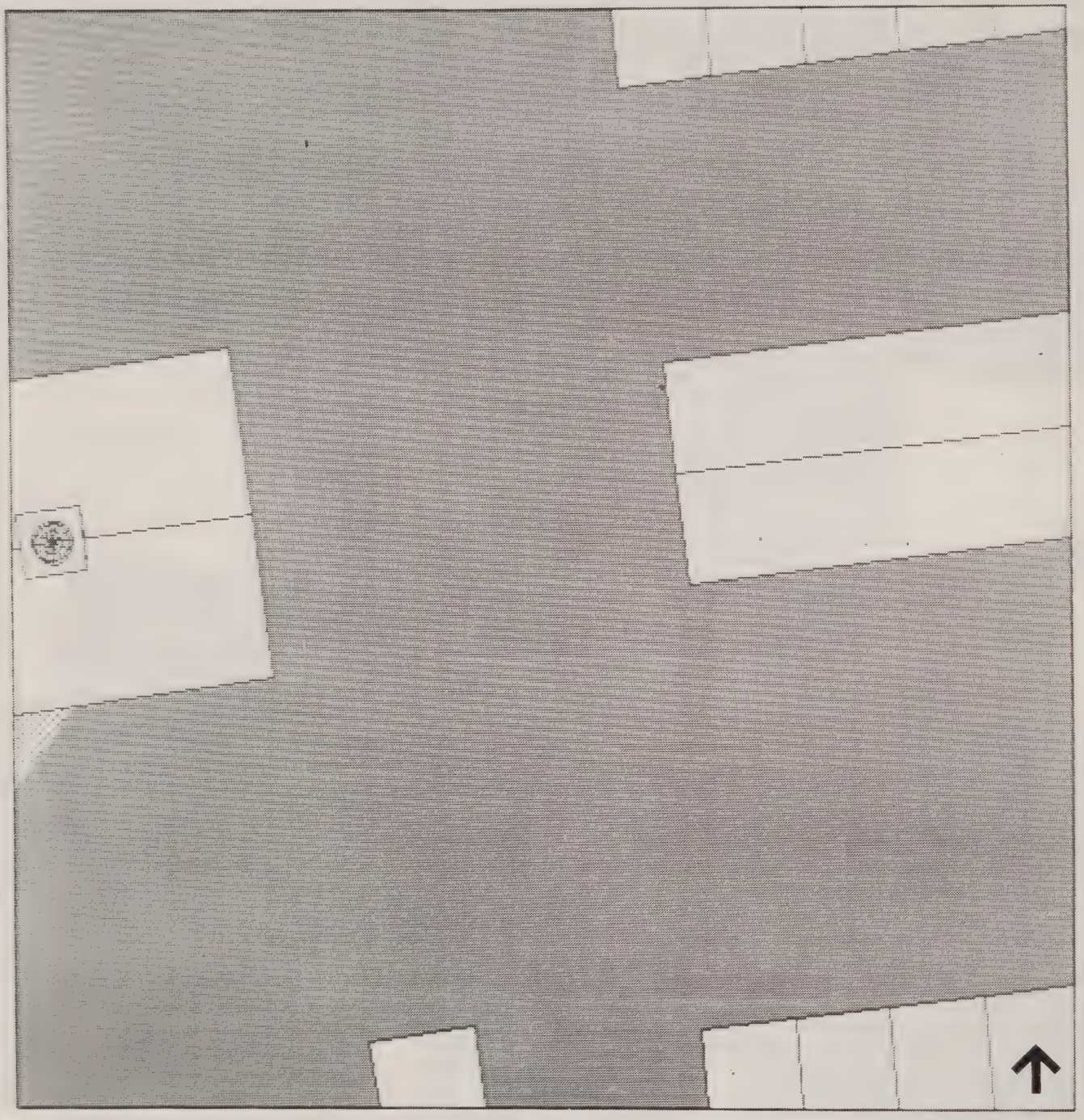
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Existing
November 21
2:00 pm

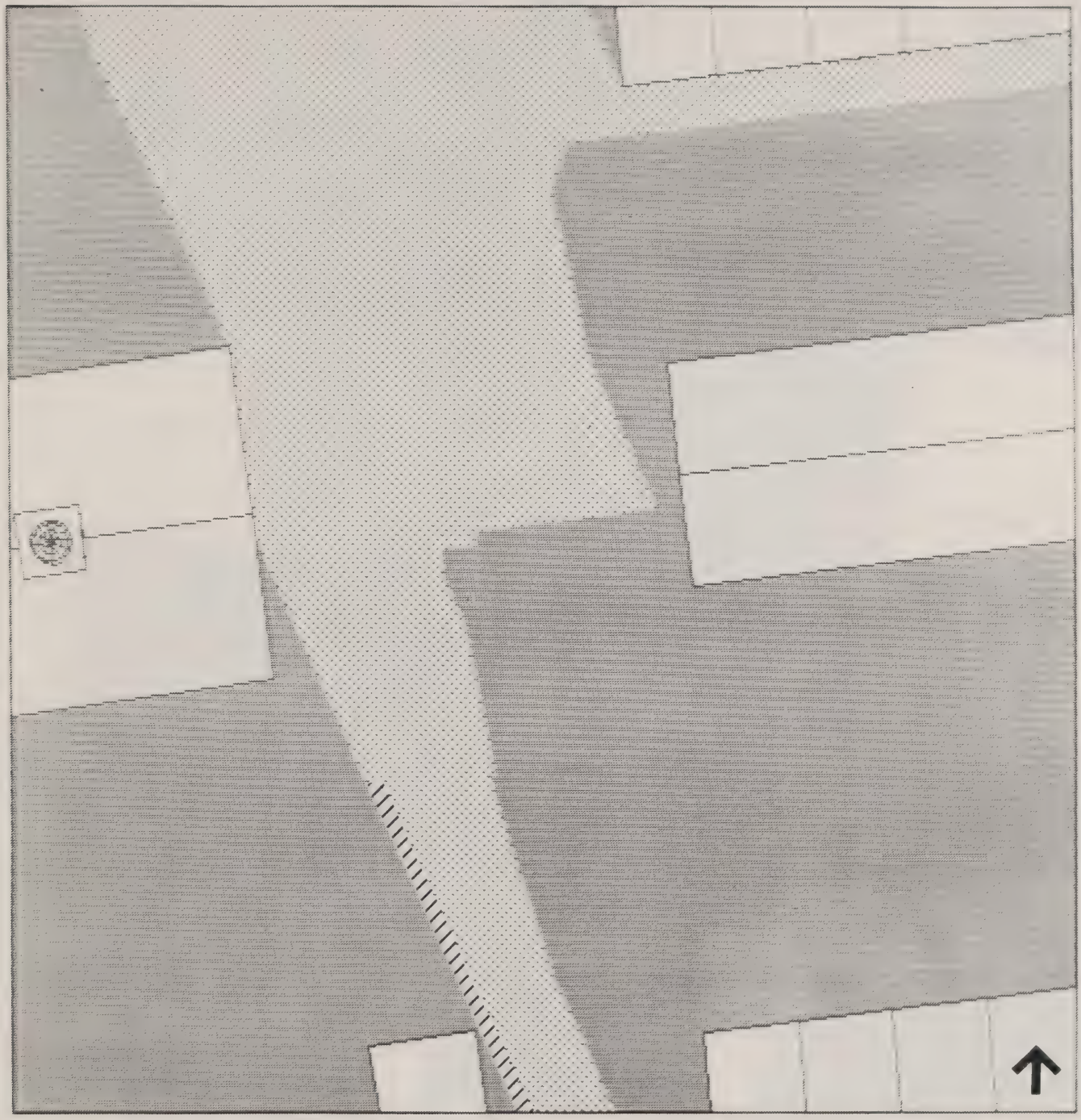
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
November 21
10:00 am

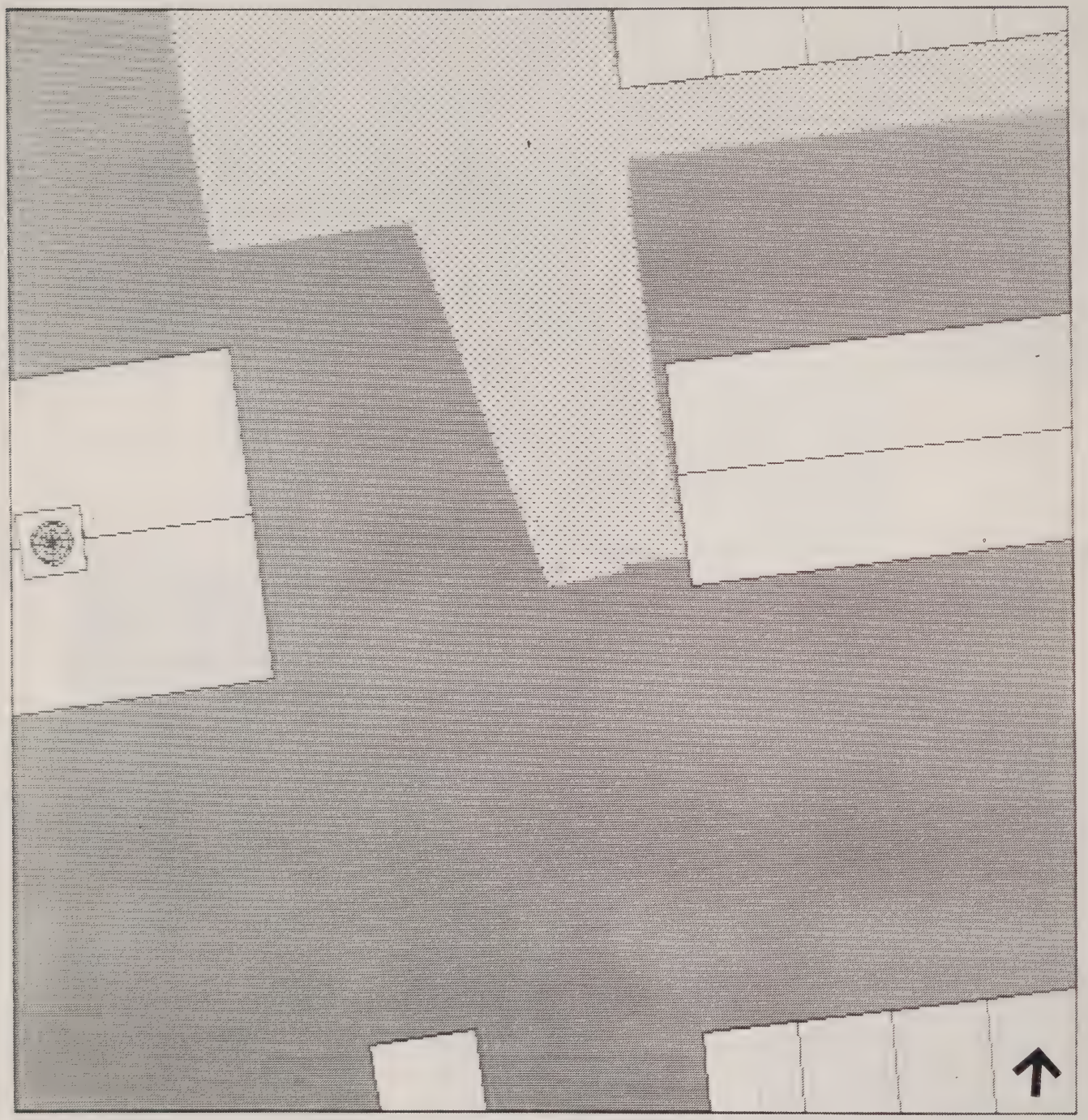
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
November 21
11:00 am

No new shadow

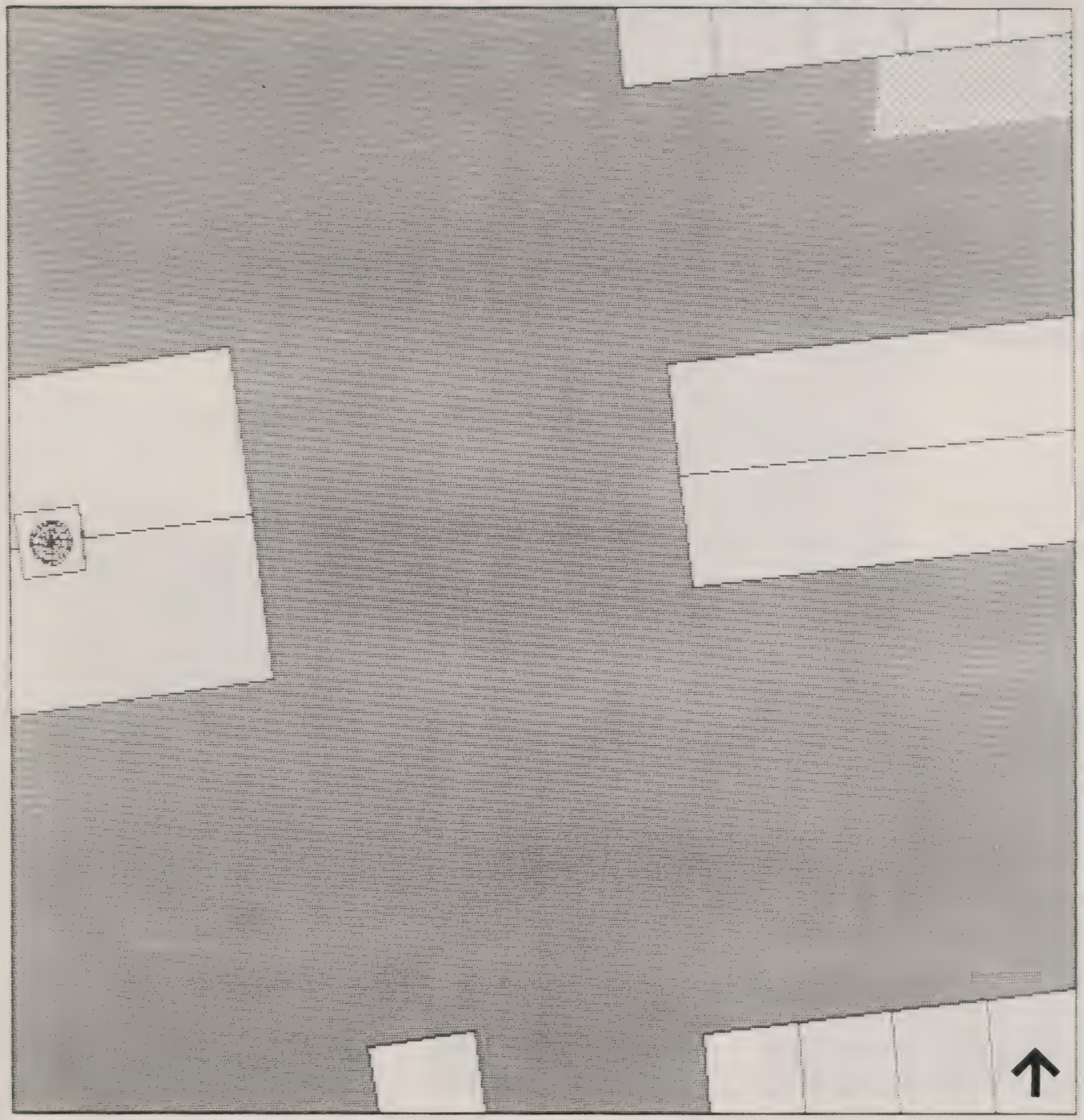
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
November 21
12:00 noon

No new shadow

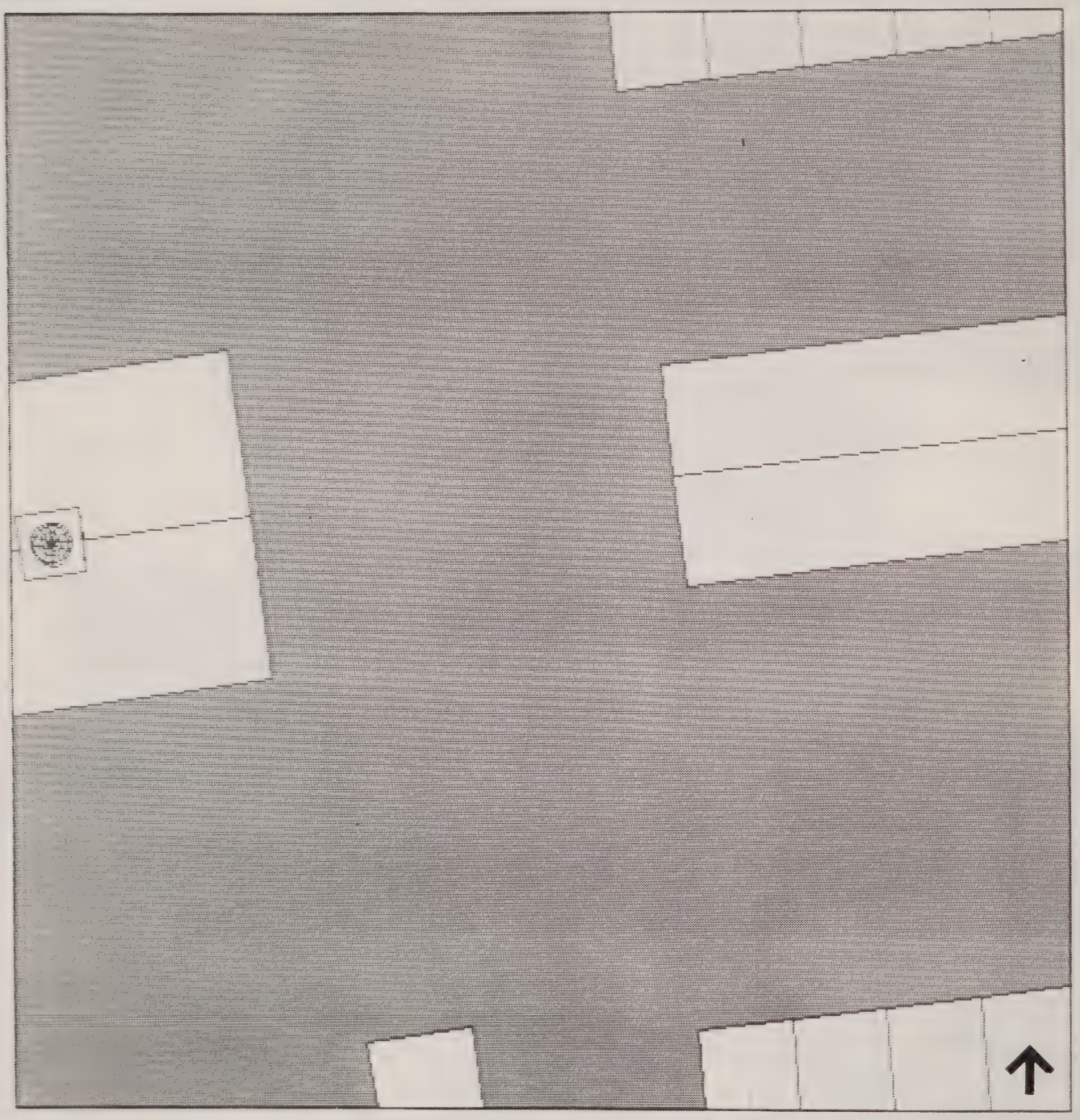
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
November 21
1:00 pm

No new shadow

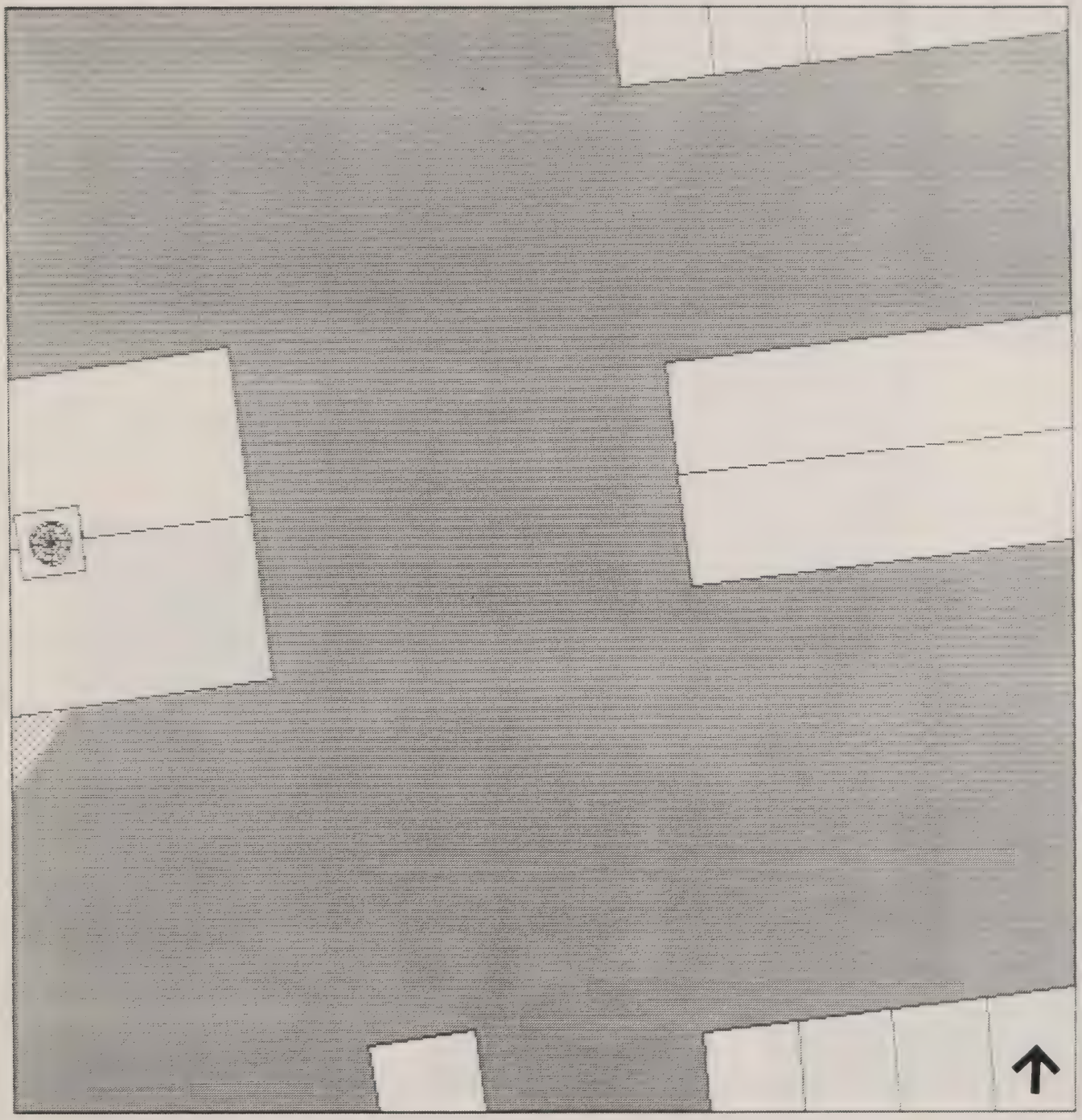
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 1
November 21
2:00 pm

No new shadow

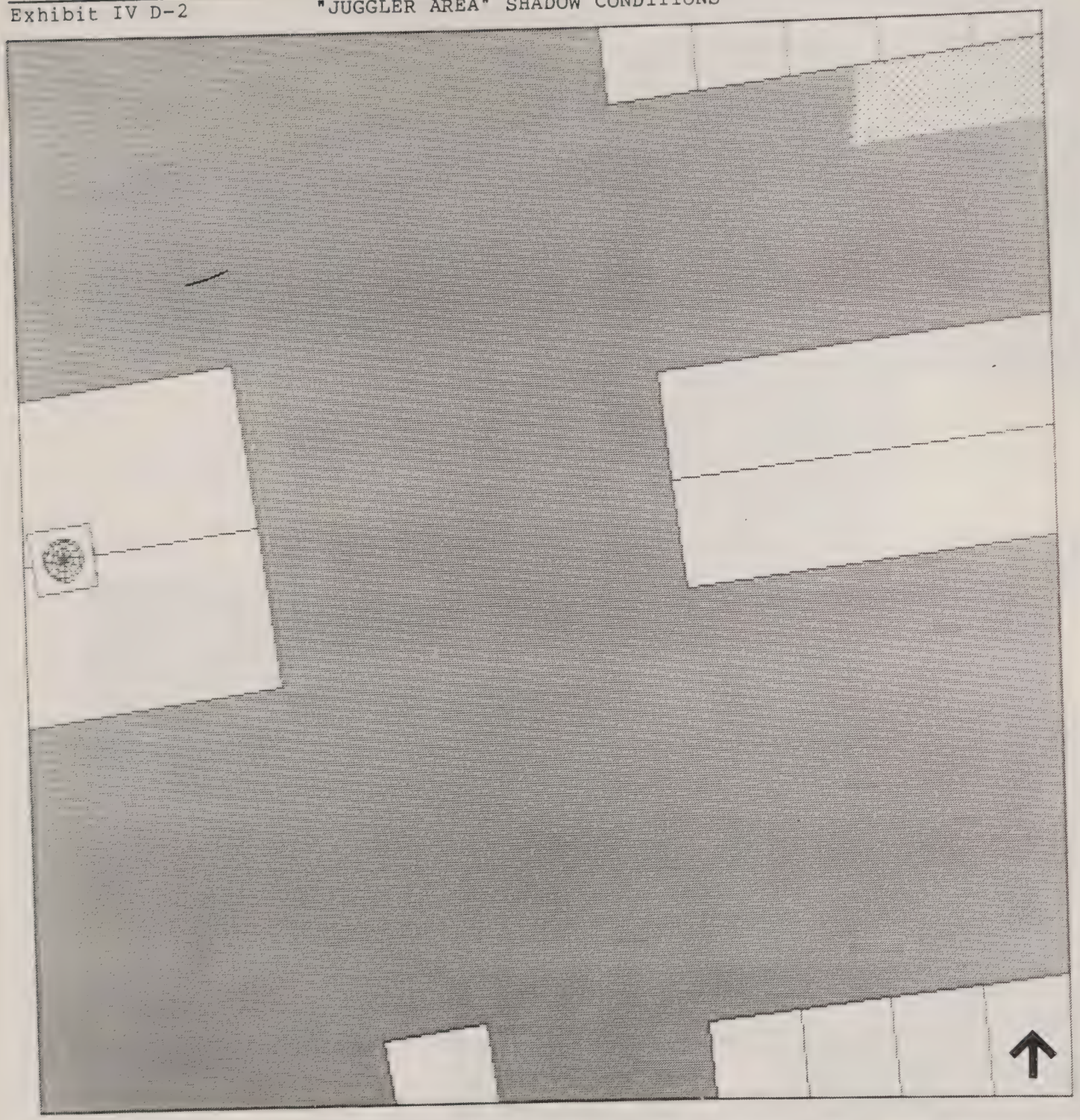
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
November 21
12:00 noon

No new shadow

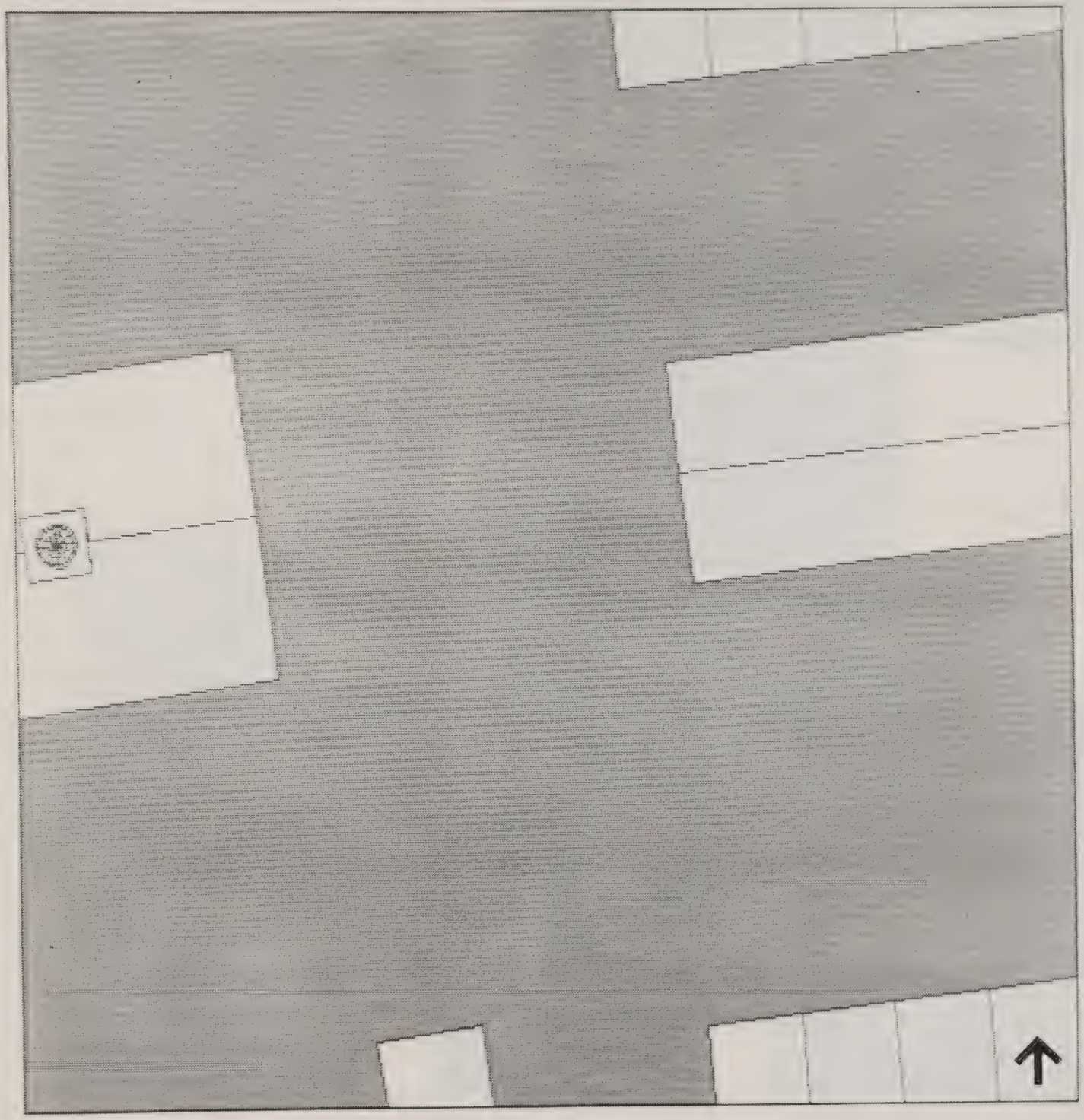
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
November 21
1:00 pm

No new shadow

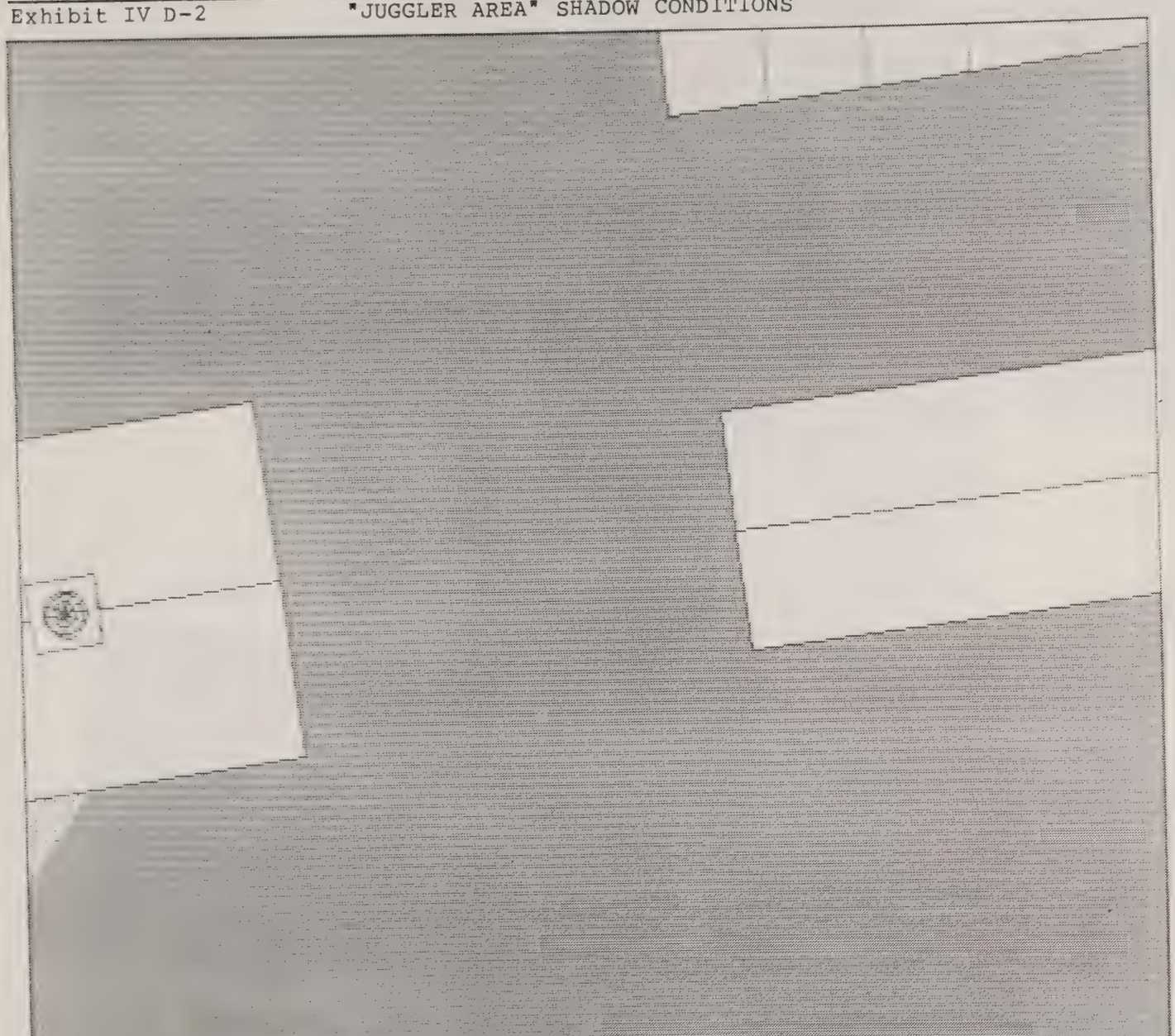
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
November 21
2:00 pm

No new shadow

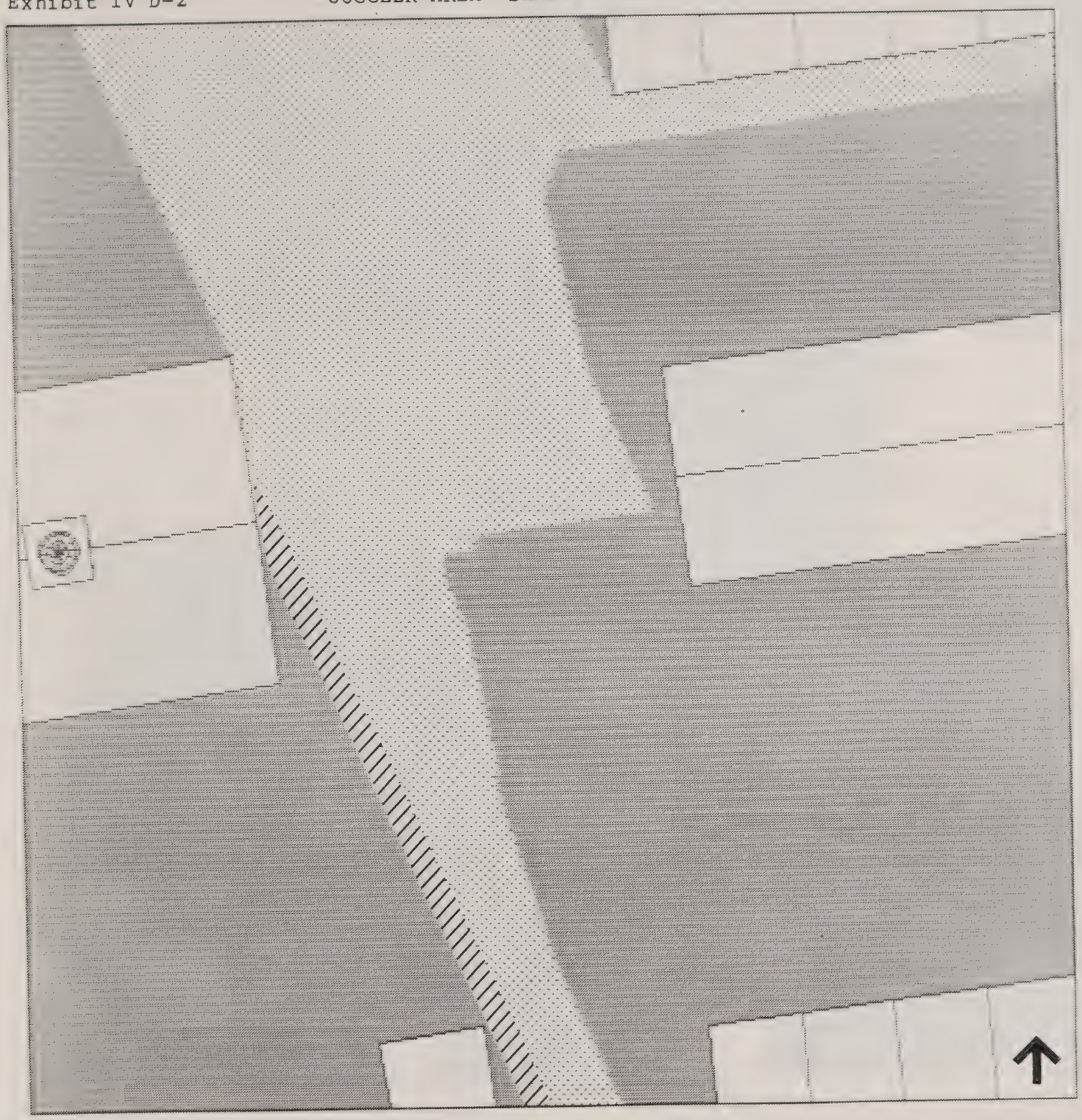
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
November 21
10:00 am

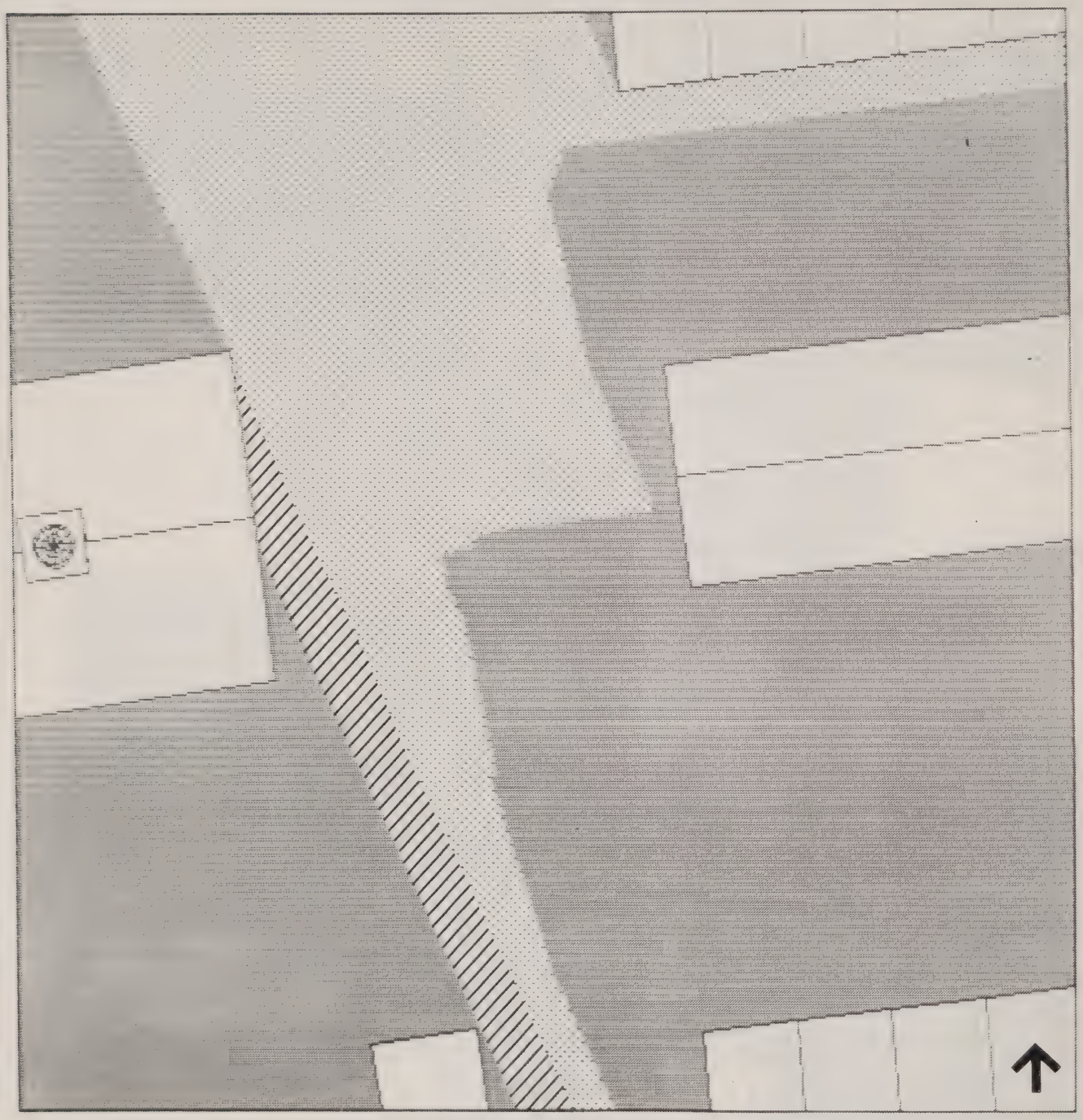
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
November 21
10:00 am

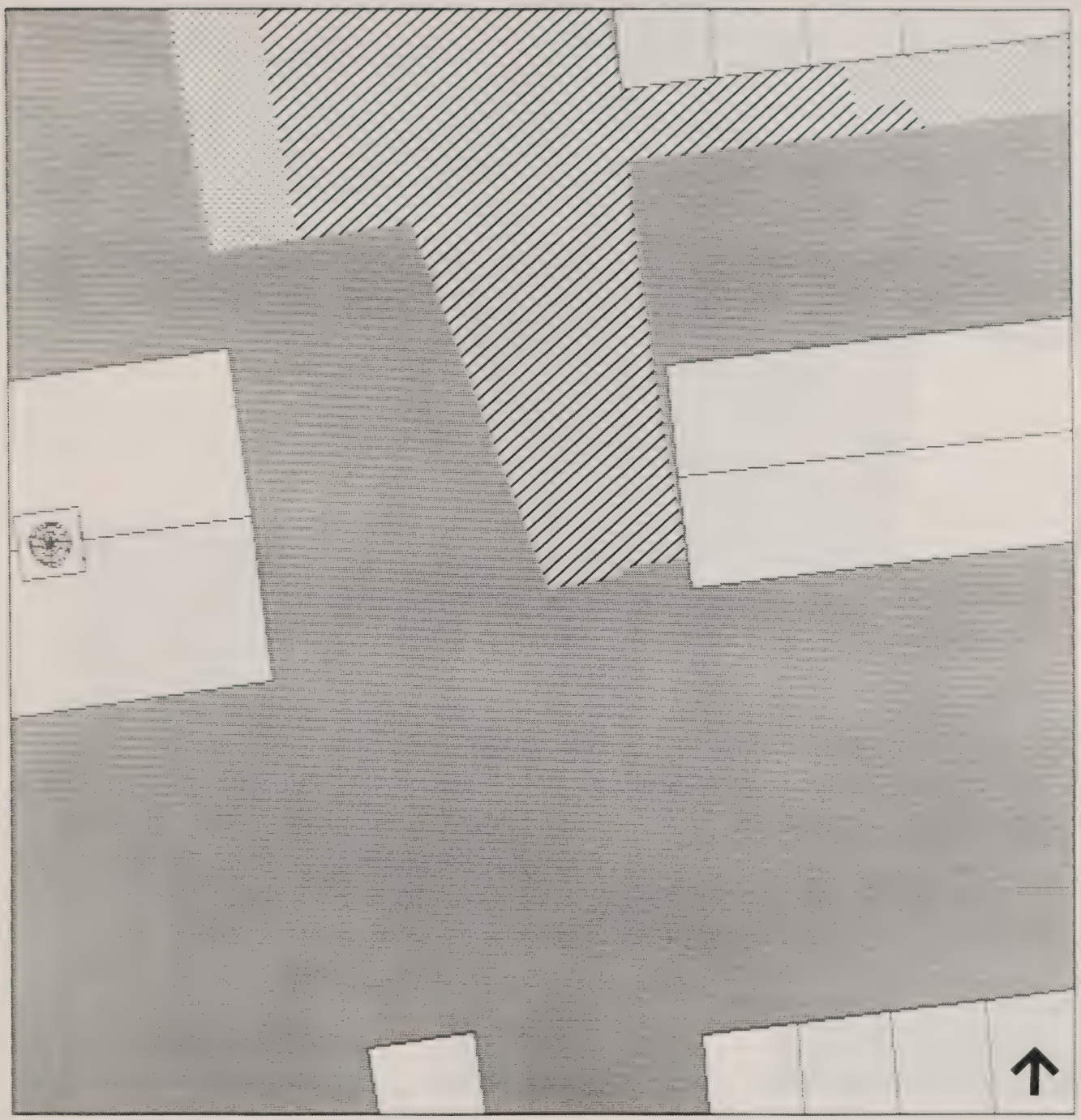
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
November 21
11:00 am

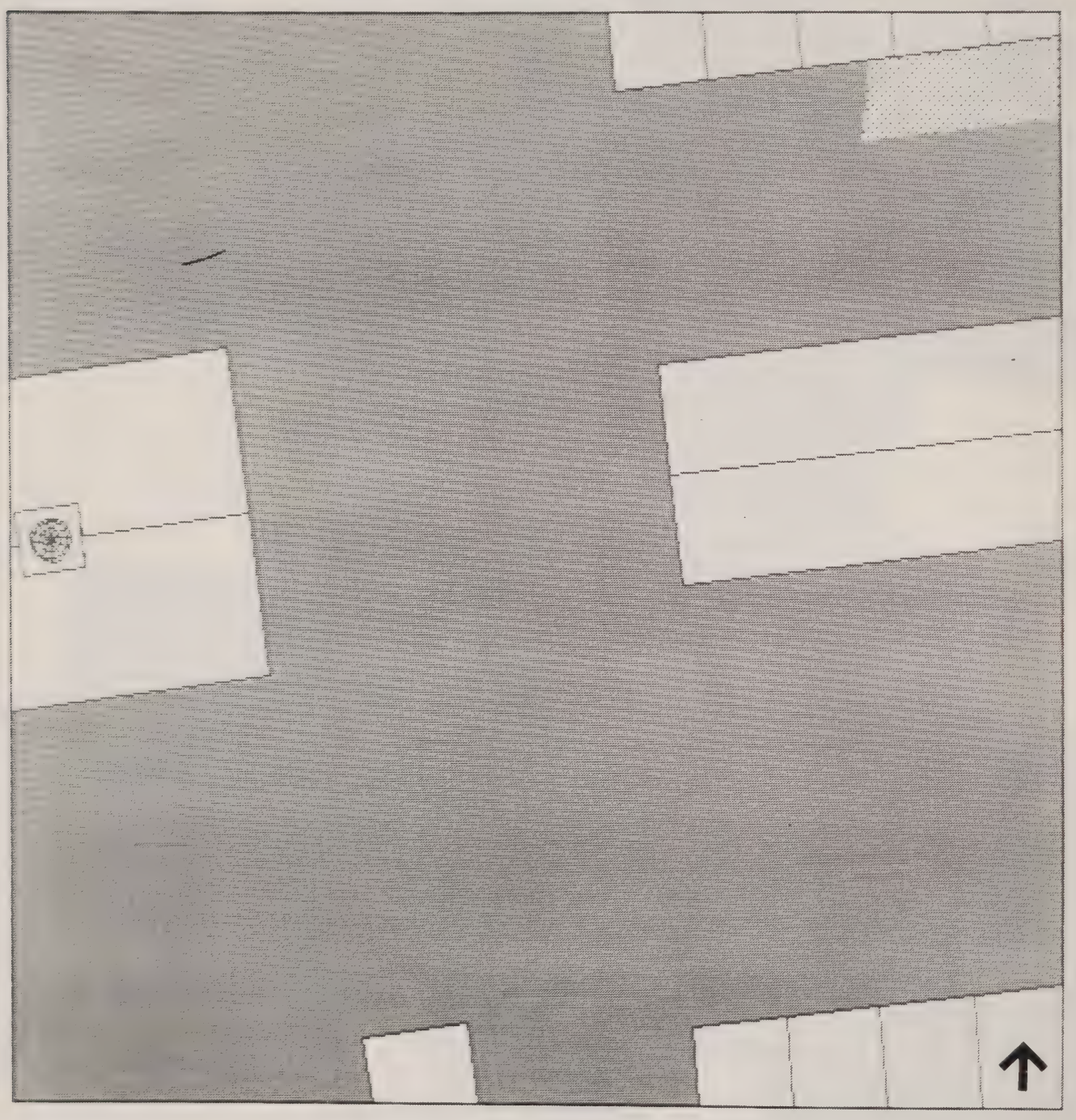
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
November 21
12:00 noon

No new shadow

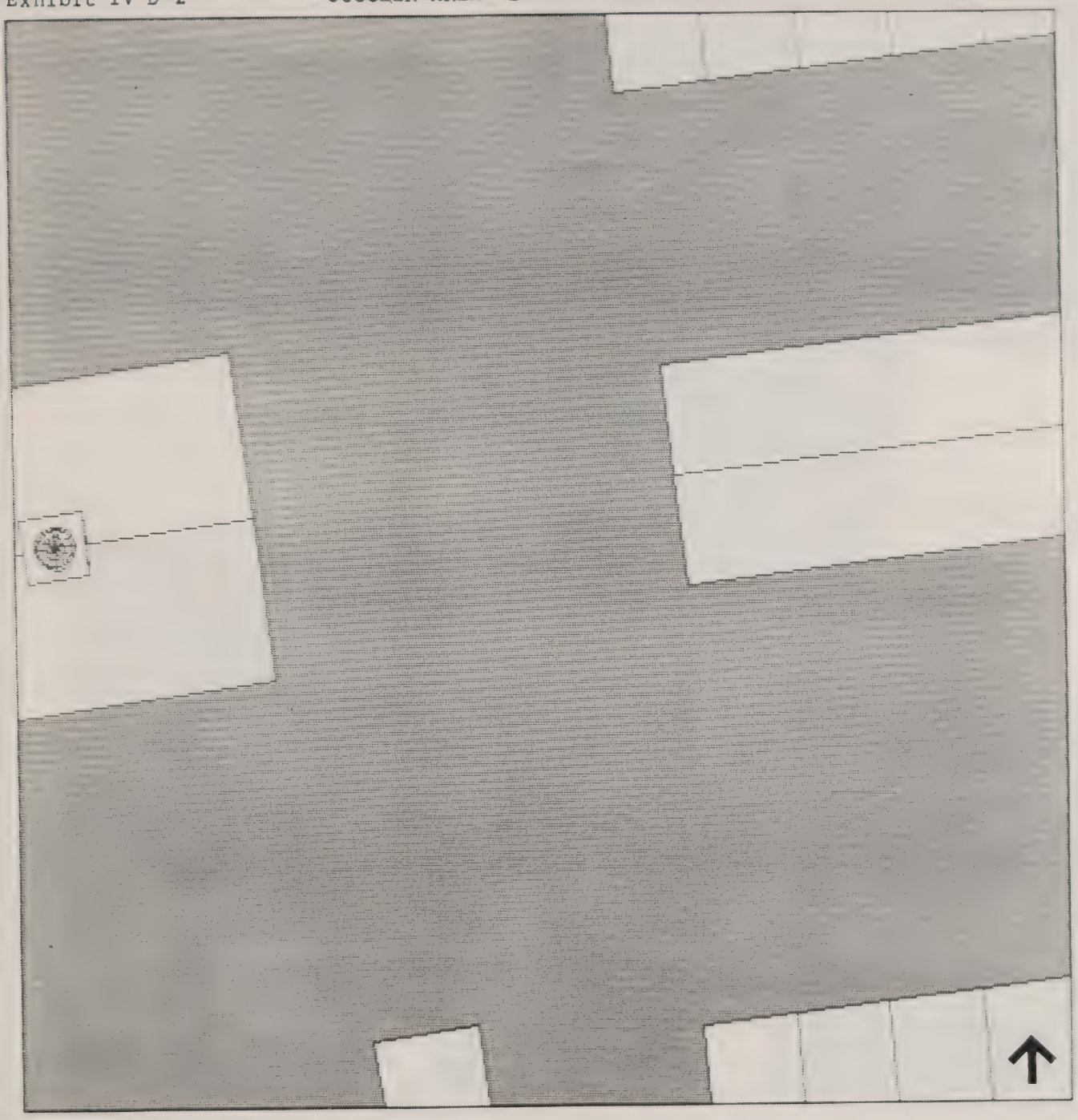
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
November 21
1:00 pm

No new shadow

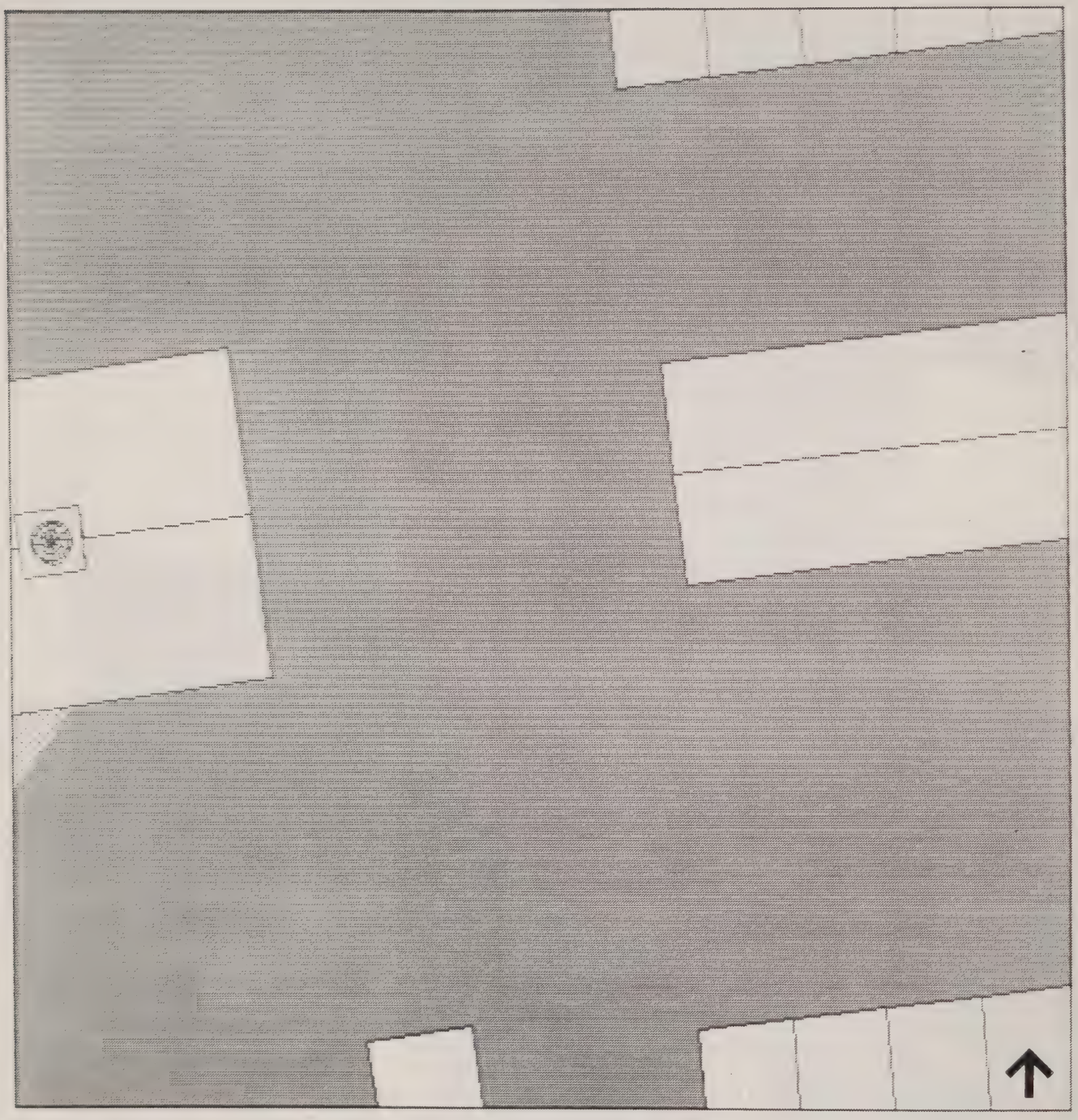
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 2
November 21
2:00 pm

No new shadow

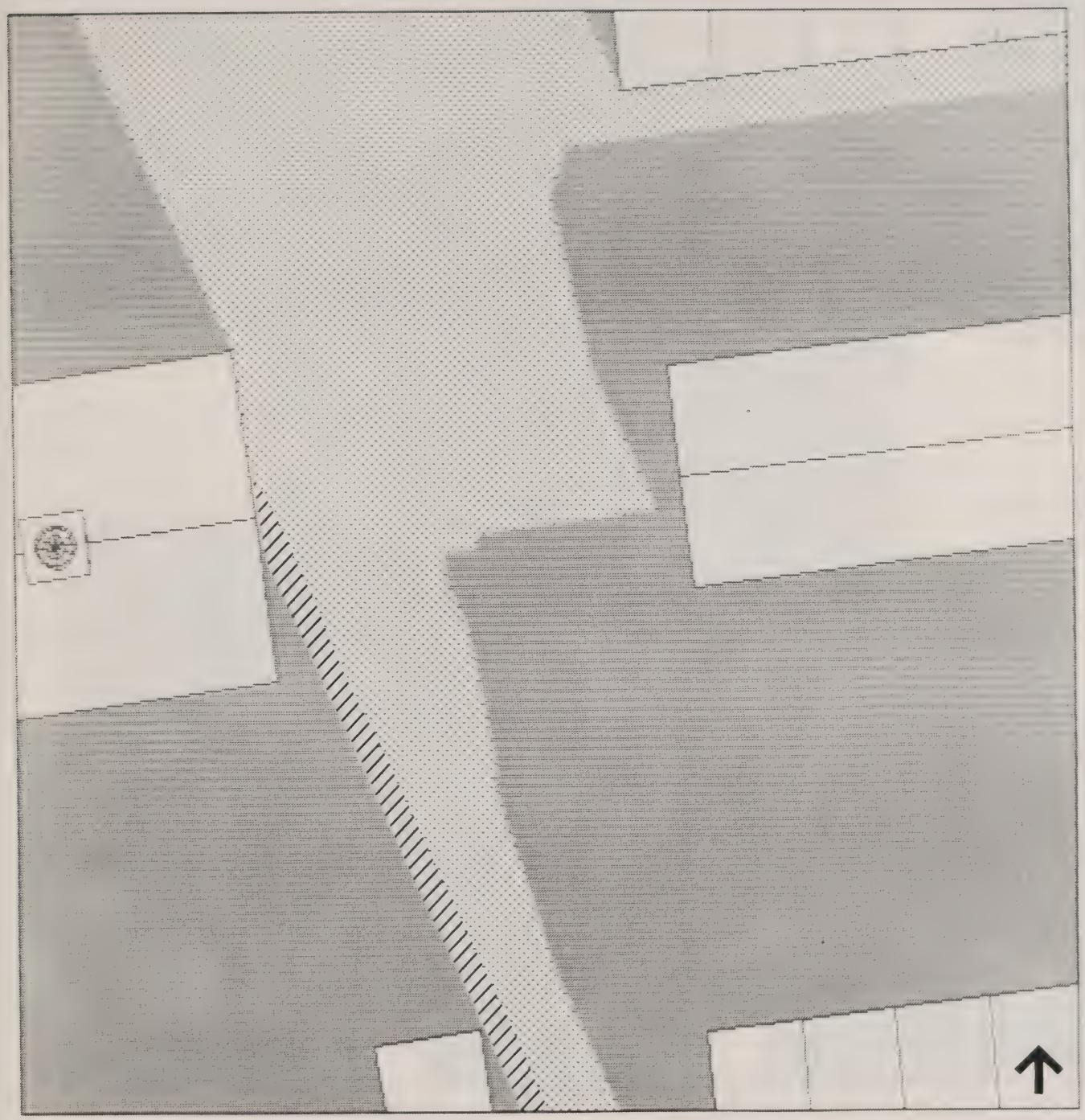
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
November 21
10:00 am

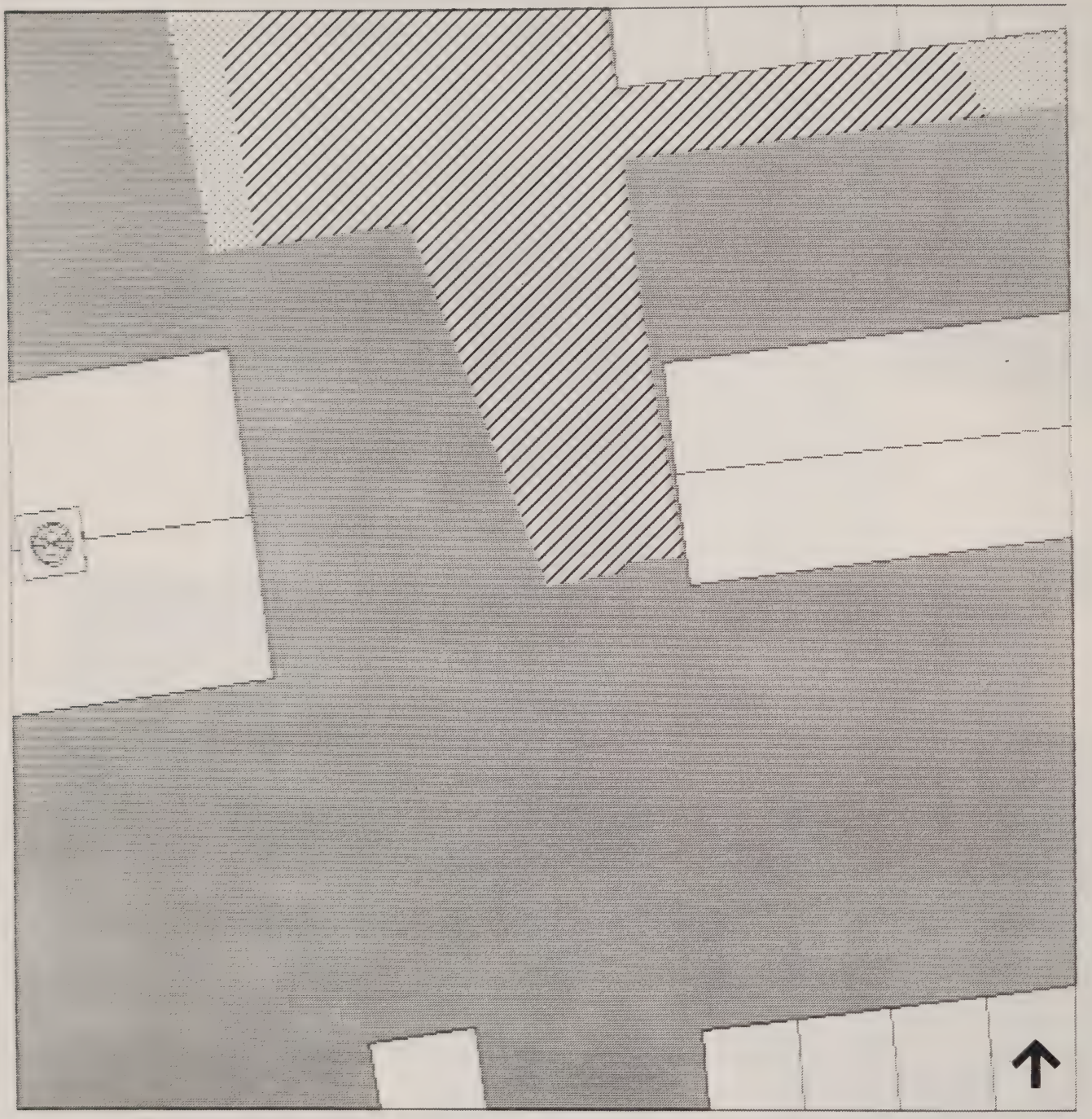
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
November 21
11:00 am

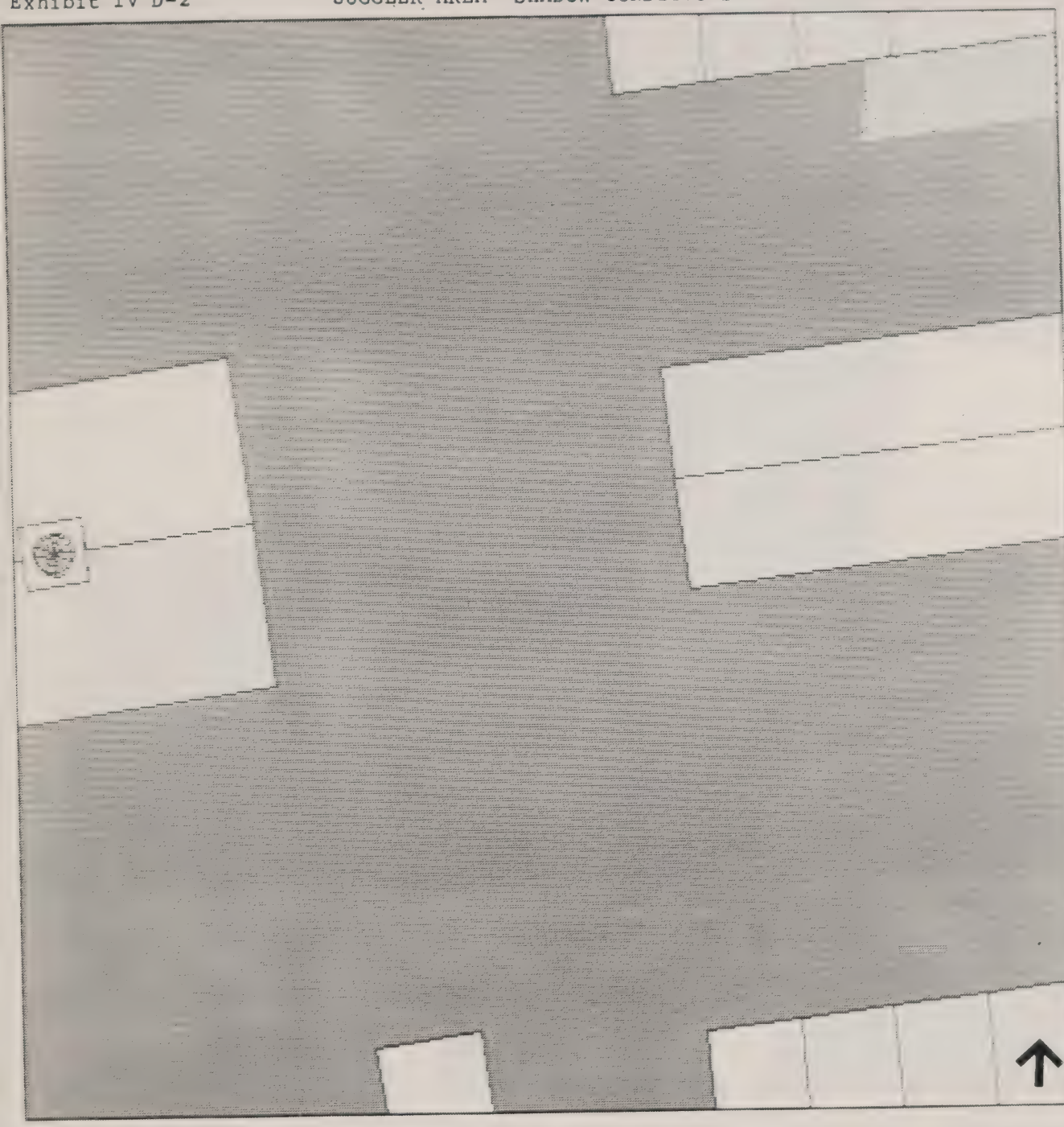
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
November 21
12:00 noon

No new shadow

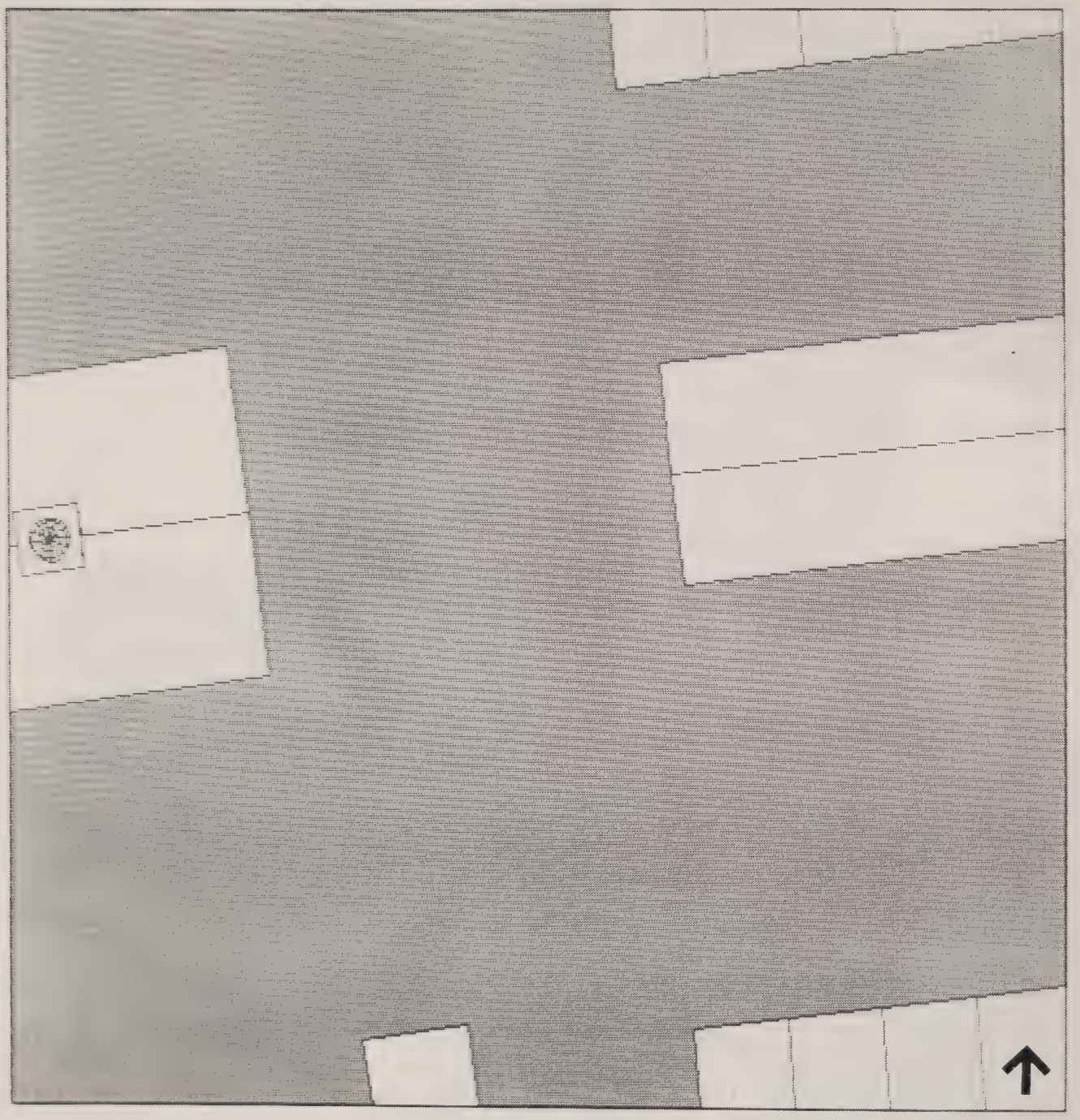
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
November 21
1:00 pm

No new shadow

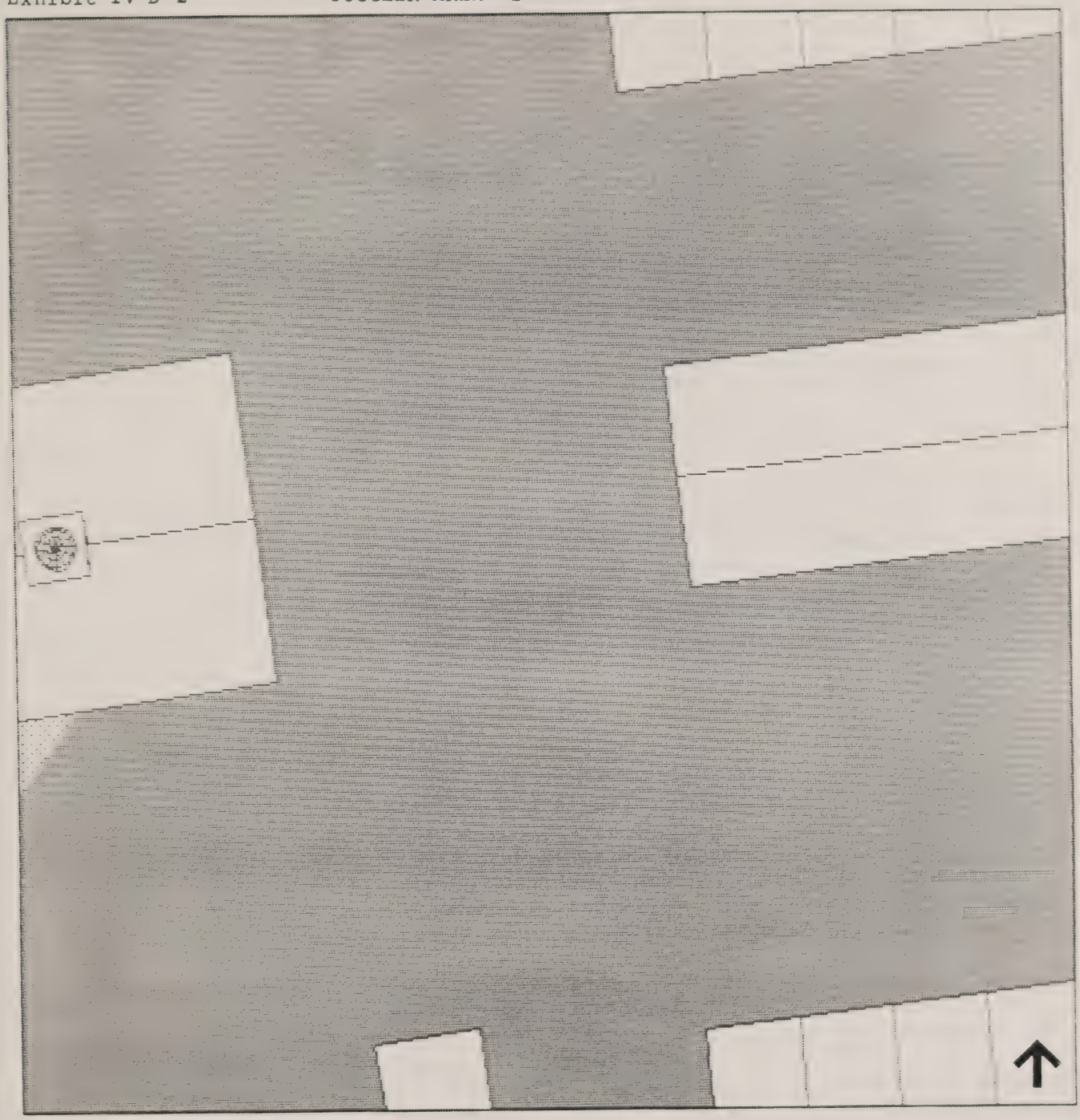
Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

Exhibit IV D-2 "JUGGLER AREA" SHADOW CONDITIONS



Alternative 3
November 21
2:00 pm

No new shadow

Existing Buildings

Shadow of Existing Buildings

Unshadowed Ground Plane

Incremental Shadow of Proposed Building

E Daylight

INTRODUCTION

In order to evaluate the development alternatives for the 99 State Street Project in terms of their relative effects on the obstruction of daylight, a system was utilized to calculate the amount of otherwise visible sky which the proposed development would occupy. This calculation was made for four different vantage points surrounding the site (see Exhibit IV E-1). The methodology used in this study was first developed by the Swedish architect, Gunnar Pleijel, in 1954. Pleijel developed a technique for measuring the percentage of unobstructed sky at any urban location.

This technique can be used to analyze existing conditions as well as the impact of proposed buildings on an existing site. The technique is based on the assumption that if no buildings existed on-site, one would have 100 percent visual access to daylight. On this basis, the effect of both existing buildings and various proposed development alternatives can be calculated in terms of the percent of sky obstructed.

METHODOLOGY

The percentage of daylight obstructed by existing or proposed buildings was calculated using a method based on a wide-angle photographic technique invented by Pleigel. This method documents daylight at any desired location by recording a distorted, yet proportional impression of the surrounding buildings on a diagram used to measure the percentage of sky obstructed.

The technique analyzes a 180 degree view of a study area as seen from a single vantage point. The 180-degree view is depicted in a form which resembles a wide-angle photograph. In order to create such a wideangle view, various angles between the selected vantage point and the building's edges and roof lines are calculated. The angles are then utilized to superimpose a drawing of the building onto a diagram which is specially designed for the purpose of compressing the actual building dimensions into the distorted dimensions of a wide-angle view (see Exhibit IV E-2).

The percentage of daylight obstructed is then calculated by dividing the wide-angle view into 100 proportionally equal segments, and by subtracting the number of segments in which no obstruction occurs from 100 percent. The resulting figure represents the approx-

imate percentage of daylight obstructed by the development condition being evaluated.

SUMMARY OF FINDINGS

View A - Kilby Street

From this vantage point the existing buildings along Kilby Street obstruct 73% of otherwise available daylight. All three of the new building configurations reviewed obstruct more daylight than does the existing block configuration. Alternative 1 obstructs the greatest amount of daylight at 90%, due primarily to obstruction associated with its higher base element. Alternatives 2 and 3 obstruct 81% and 82% of daylight, respectively. Because View A is aligned with the tower element along Kilby Street, it represents the point along the street at which daylight obstructed by the project is greatest. If the view were seen from closer to State Street, less obstruction would be indicated.

View B - State Street

From this vantage point under existing conditions, the total block obstructs 77% of available daylight. Once again, Alternative 1 obstructs the greatest amount of daylight at 85%, due primarily to obstruction associated with its higher base element. Alternatives 2 and 3 obstruct 77% and 78% of daylight, respectively, representing little or no change over existing conditions.

View C - Broad Street

From this vantage point, existing conditions cause a 72% obstruction of daylight. Neither Alternatives 1, 2 or 3 cause any further obstruction. This is due to the fact that existing buildings are over 100 feet tall, and the proposed development alternatives are set back far enough into the block so as to avoid any further effects on daylight obstruction.

View D - Water Street

Although buildings along Water Street are relatively low, none of the development alternatives cause a significant increase in daylight obstruction from this vantage point, due primarily to the narrowness of the

street and the resulting angle of view of the project area, which is set back within the block. Existing conditions seen from this vantage point cause 80% obstruction of daylight. The only alternative causing any change is Alternative 3, which increases the obstruction of daylight from this vantage point by one percent.

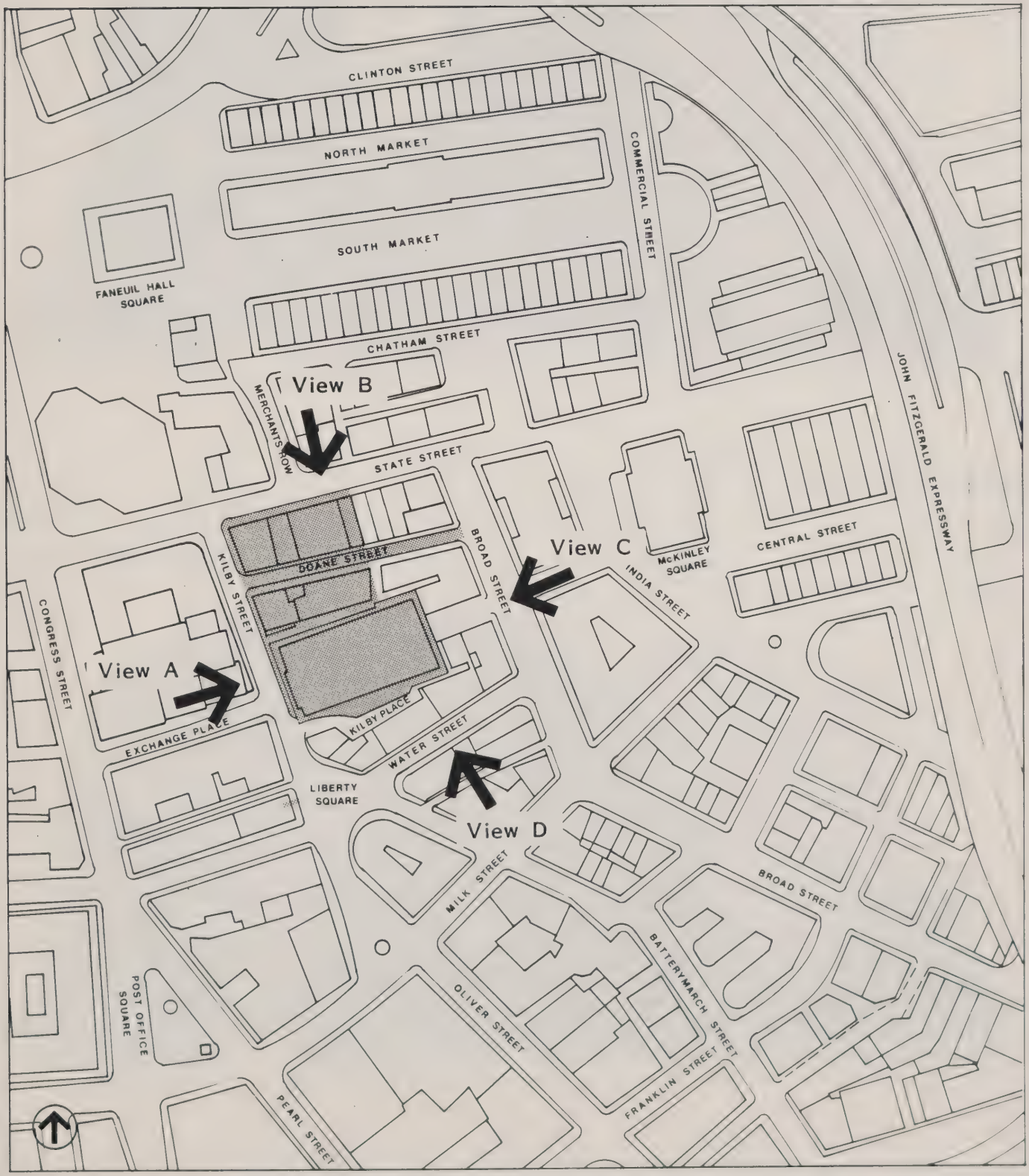
GENERAL CONCLUSIONS

Seen from the State Street or Kilby Street vantage points, Alternative 1 obstructs a greater percentage of daylight than does either Alternative 2 or Alternative 3. This is due primarily to the fact that Alternative 1 includes a higher base element set close to the street edge, creating a greater effect on daylight obstruction than is created by higher tower elements set back within the block. From these vantage points, the effects of Alternative 2 and Alternative 3 are roughly equivalent. Viewed from State Street, Alternatives 2 and 3 represent little or no change over existing conditions.

As seen from Broad Street or Water Street, none of the development alternatives cause any significant change in daylight obstruction over existing conditions. This is due primarily to the fact that the project site is set back within the block.

Exhibit IV E-1

VIEWS ANALYZED



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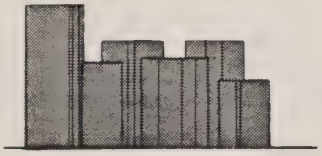
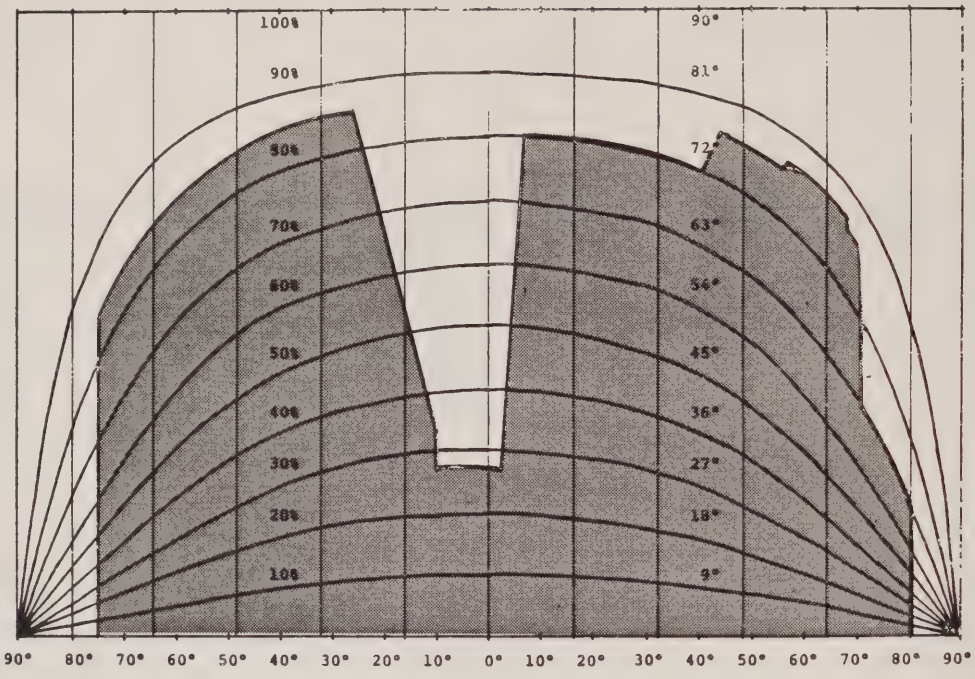


Kilby Street



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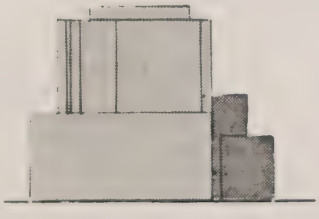

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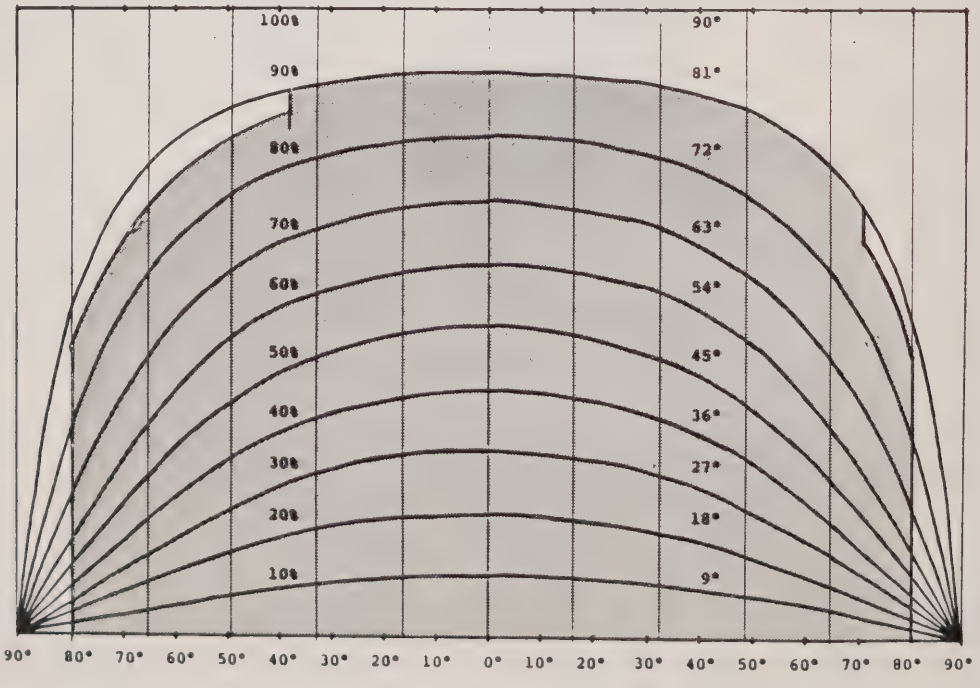
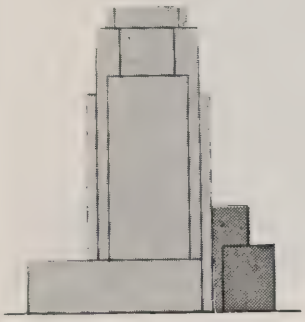
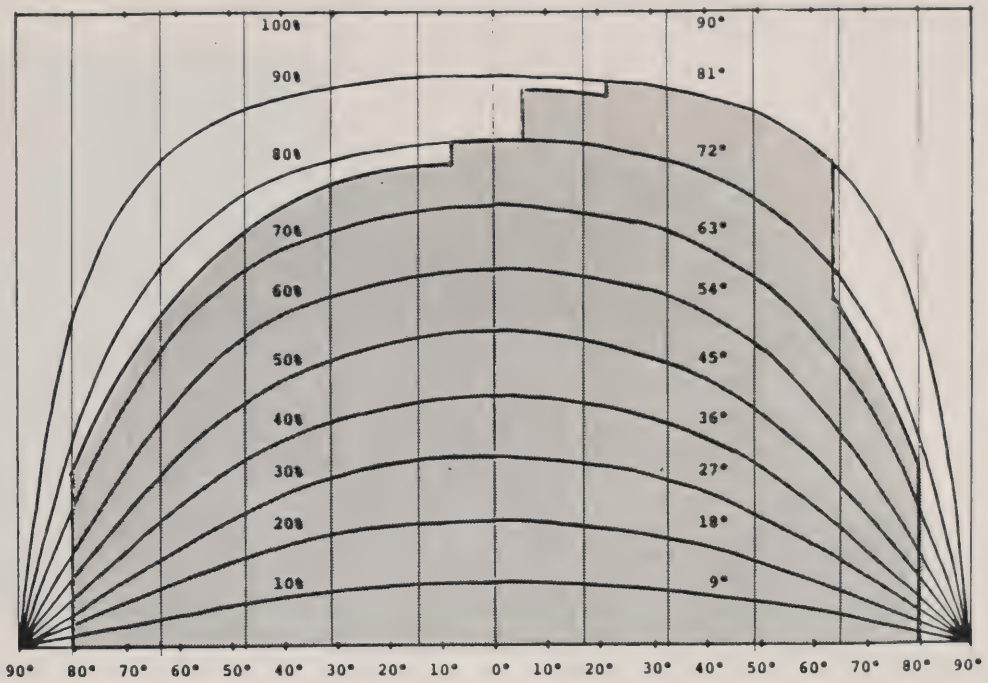


Alternative 1 View A 90%





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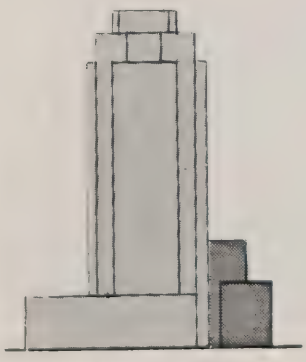
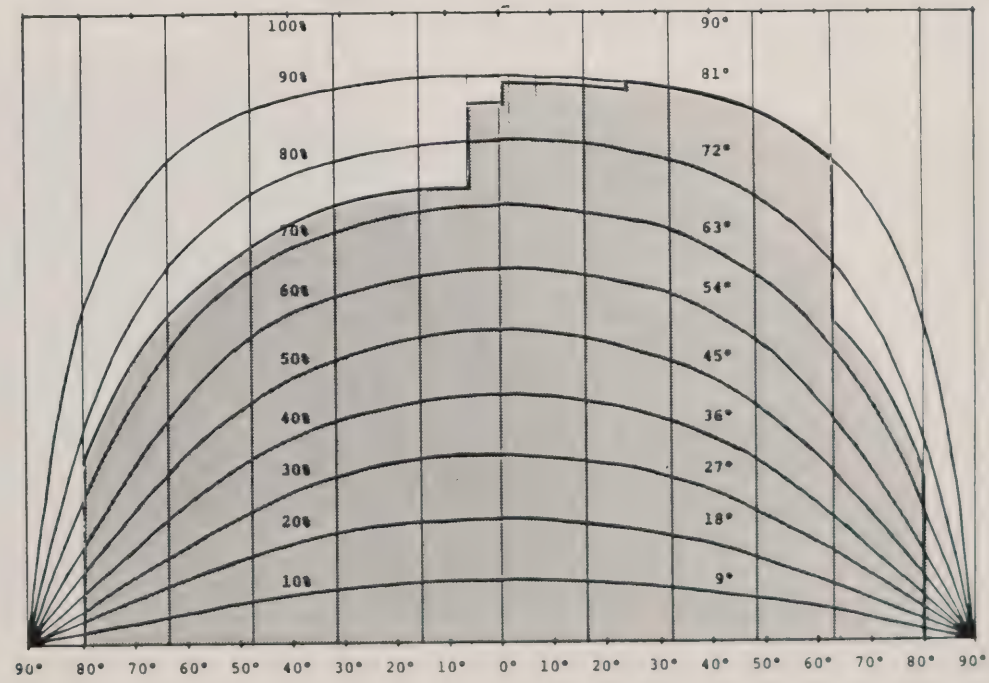
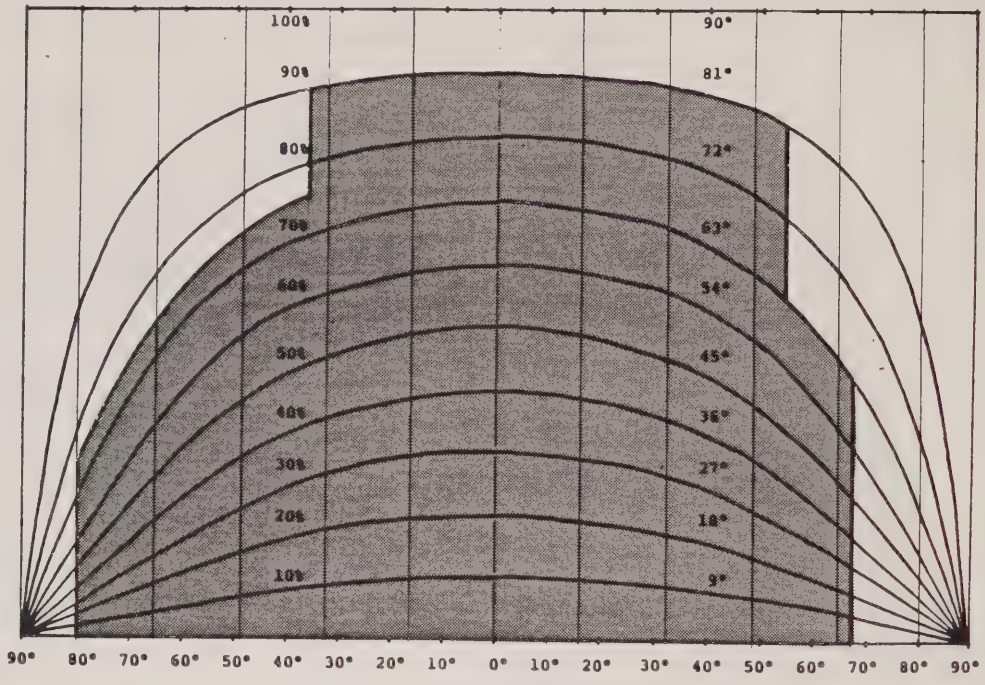




Alternative 3 View A 82%

State Street



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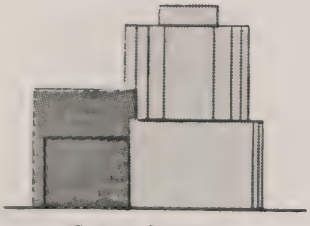

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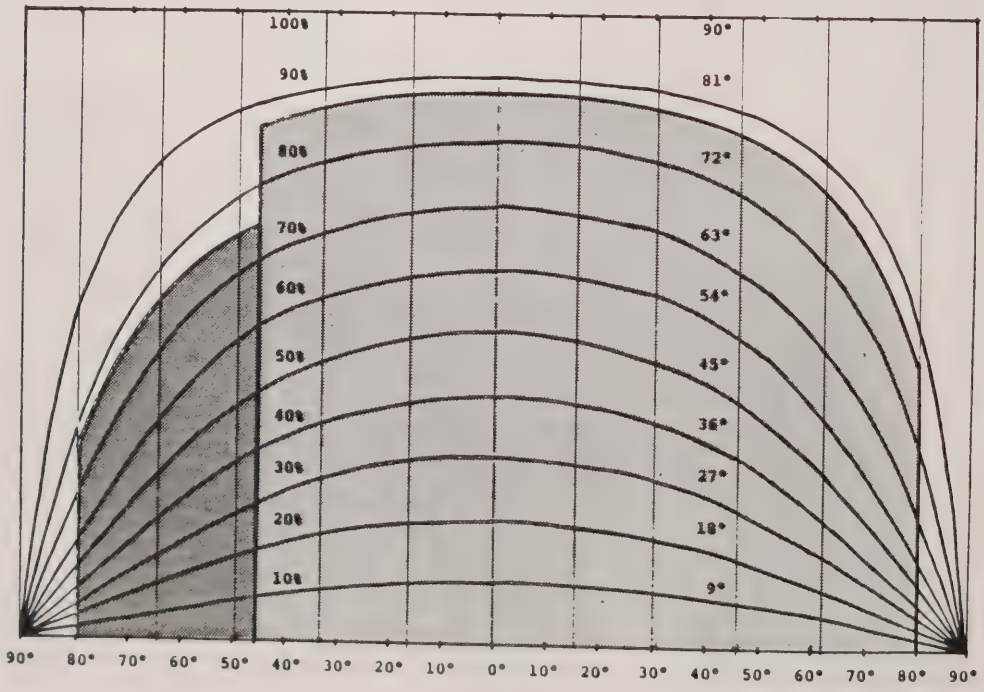

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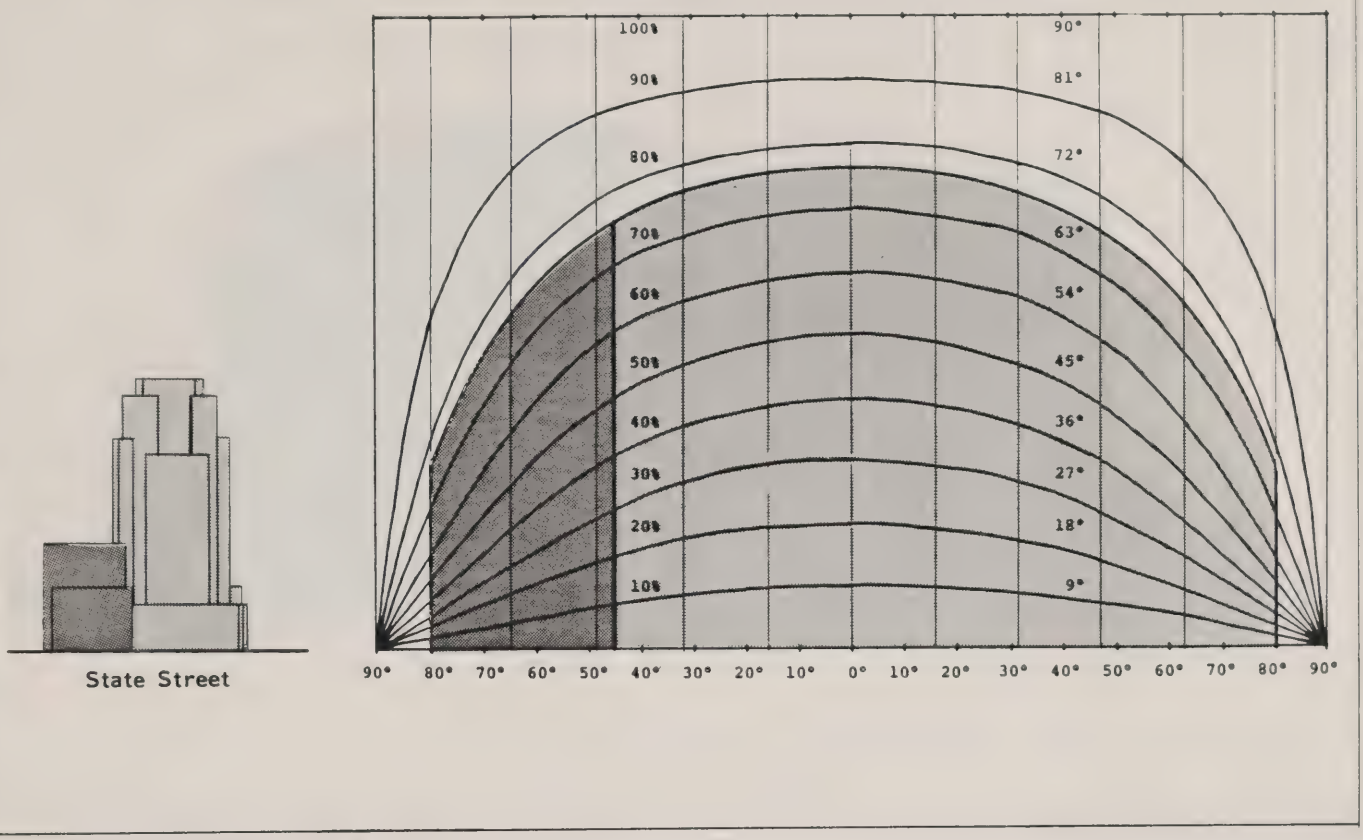

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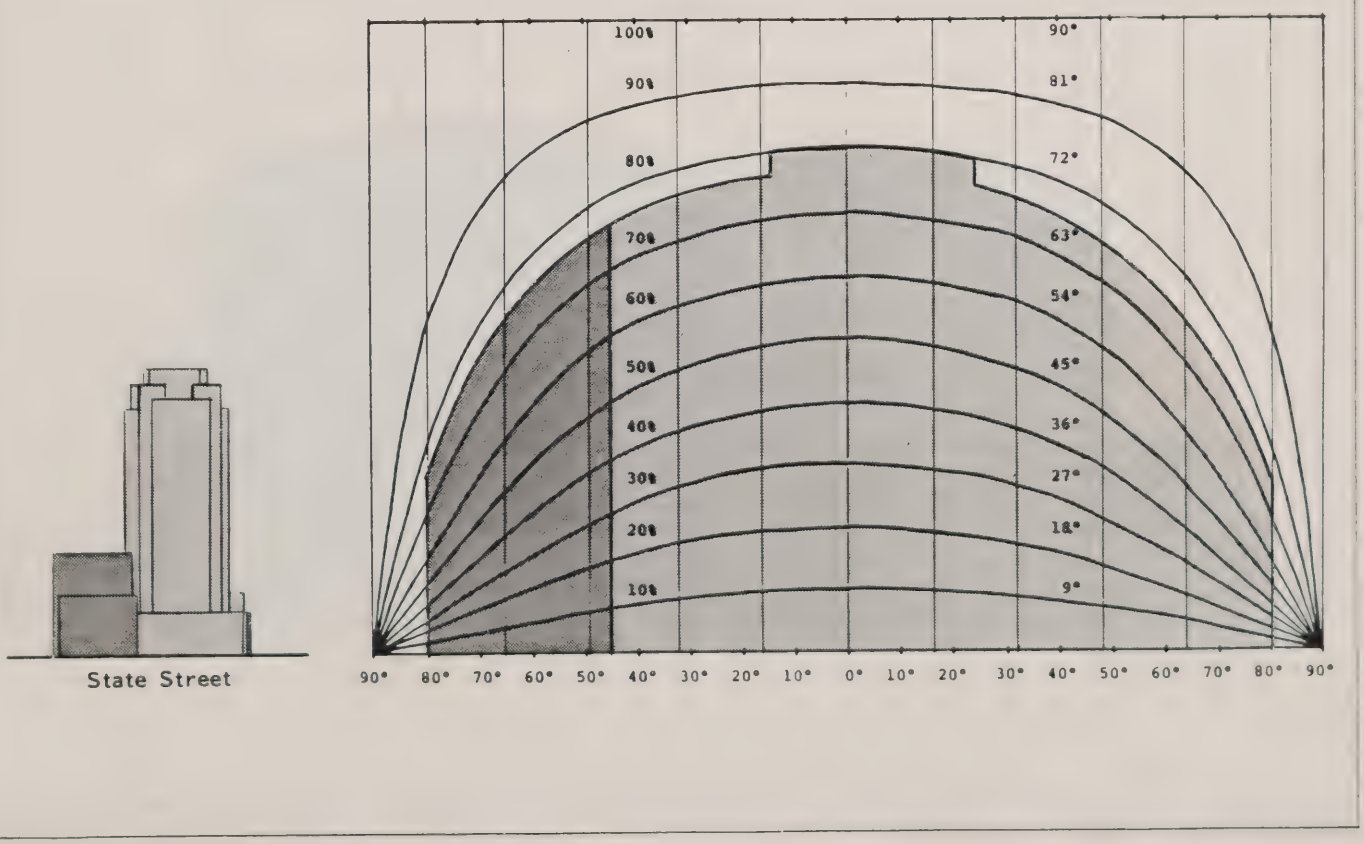

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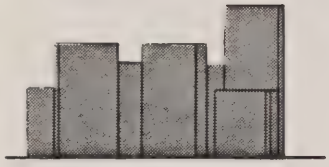
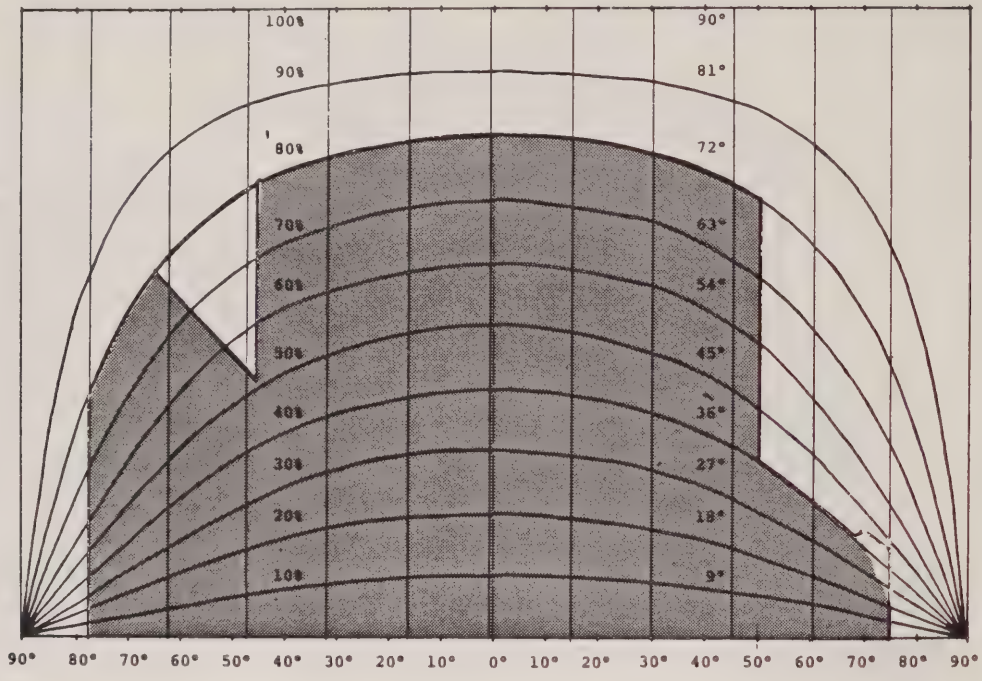


Broad Street



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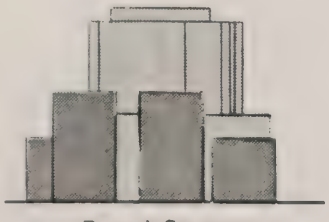

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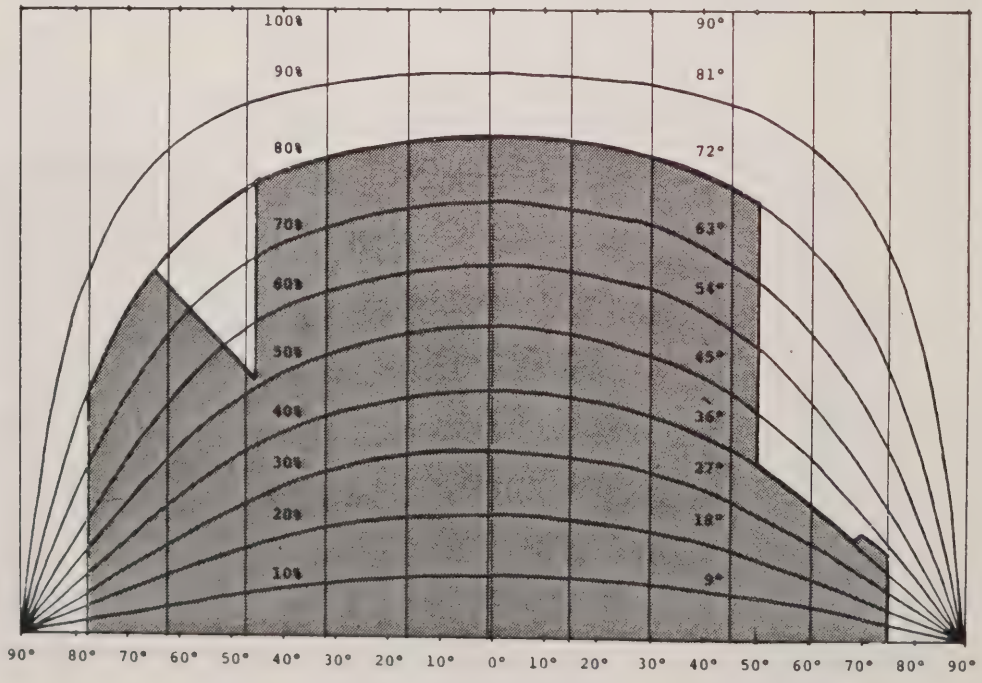

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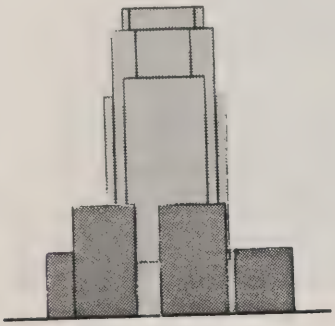

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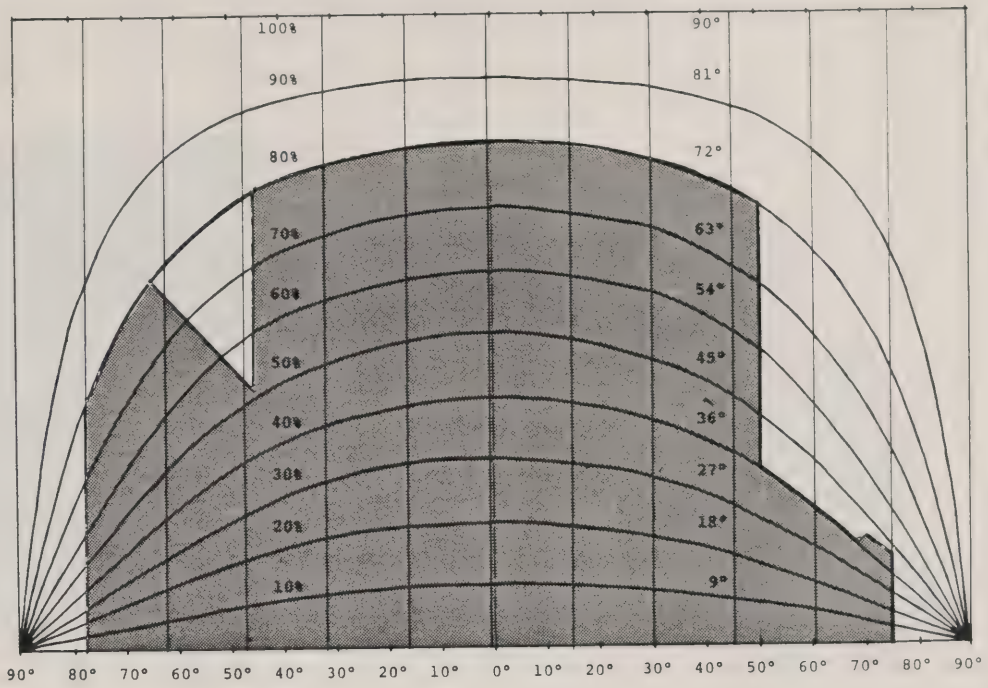

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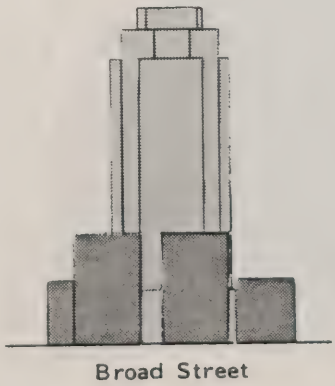

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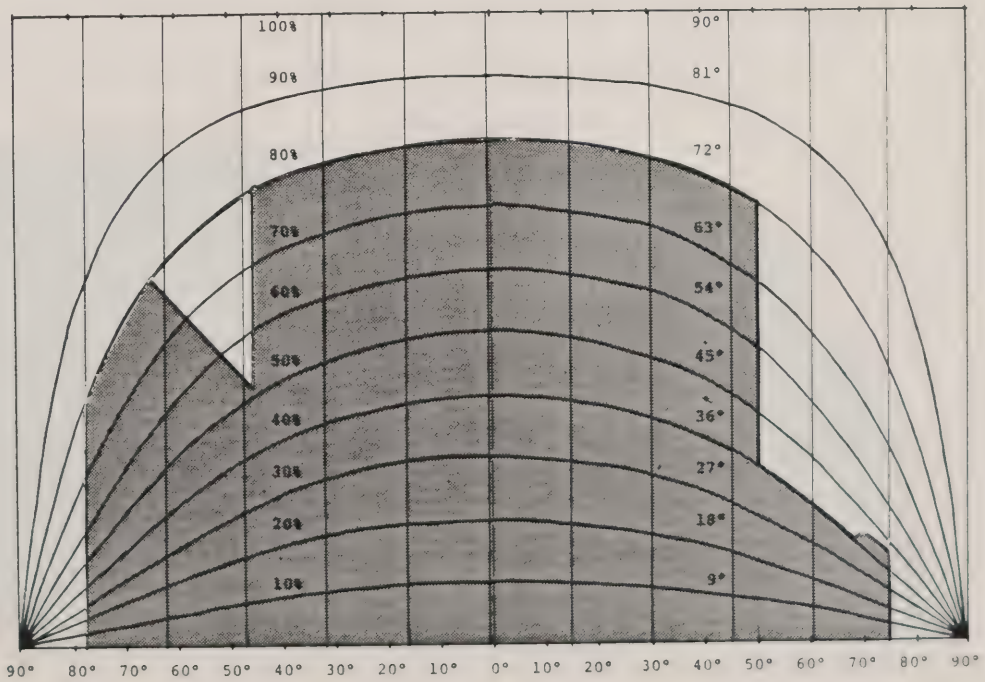

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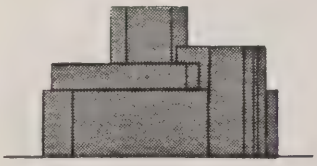
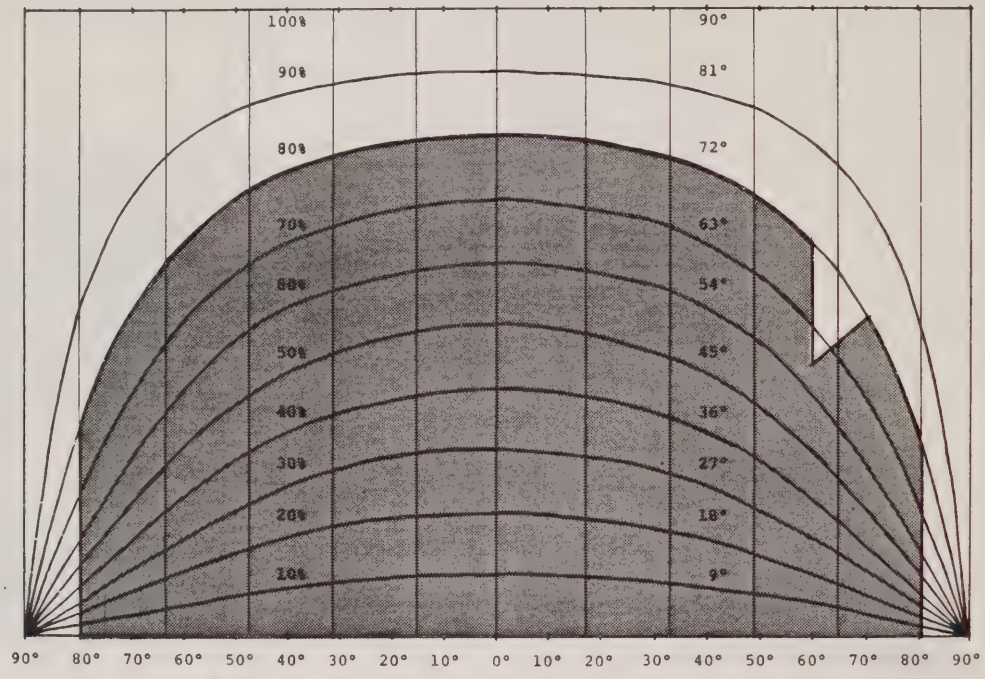
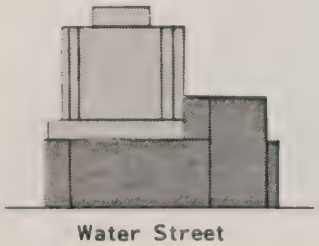
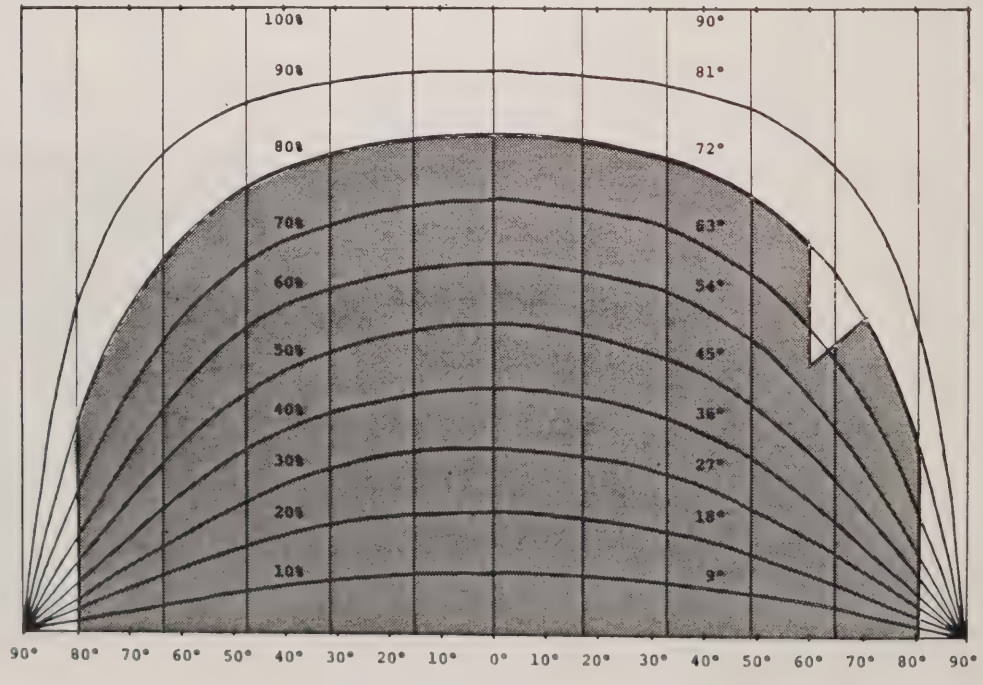




Existing View D 80%





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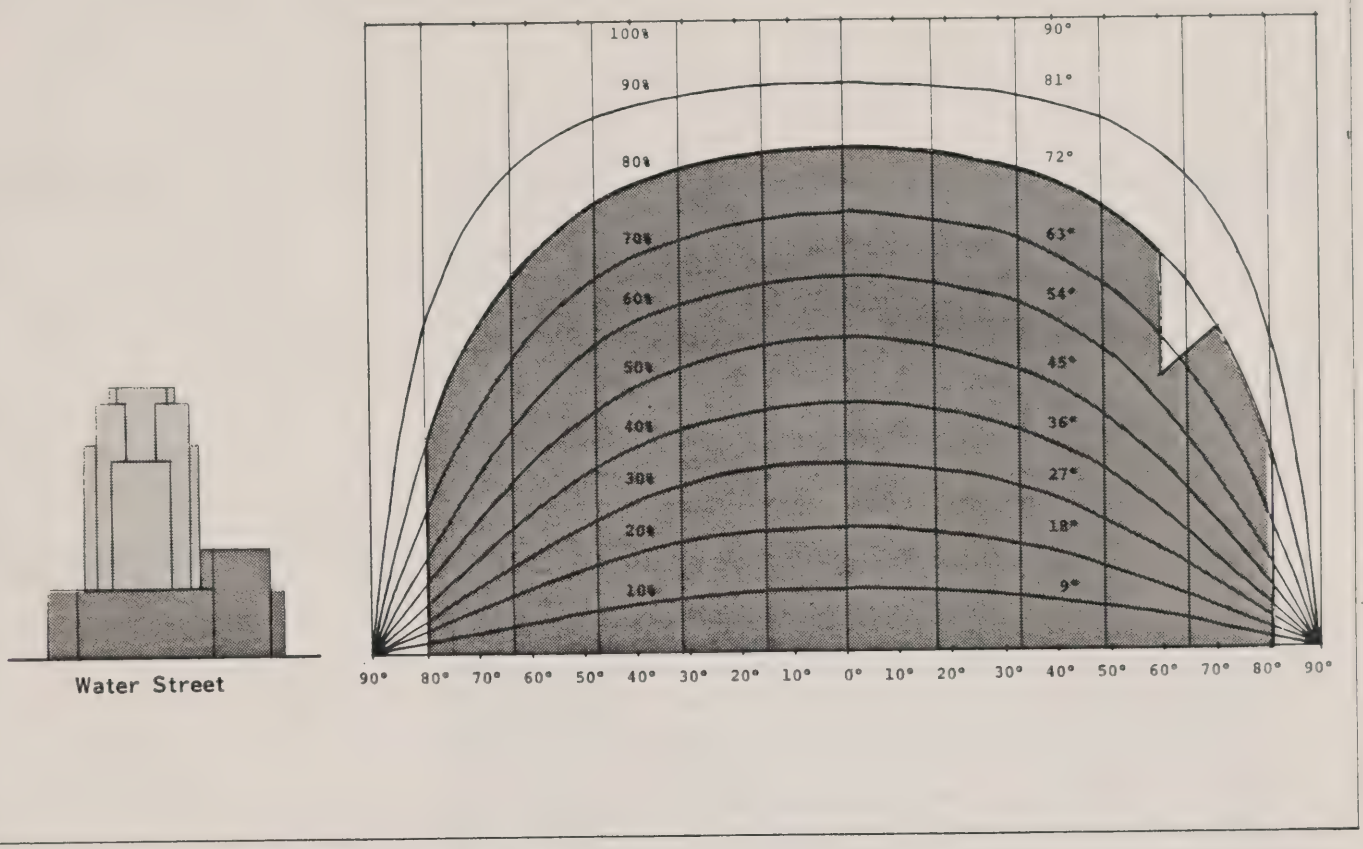

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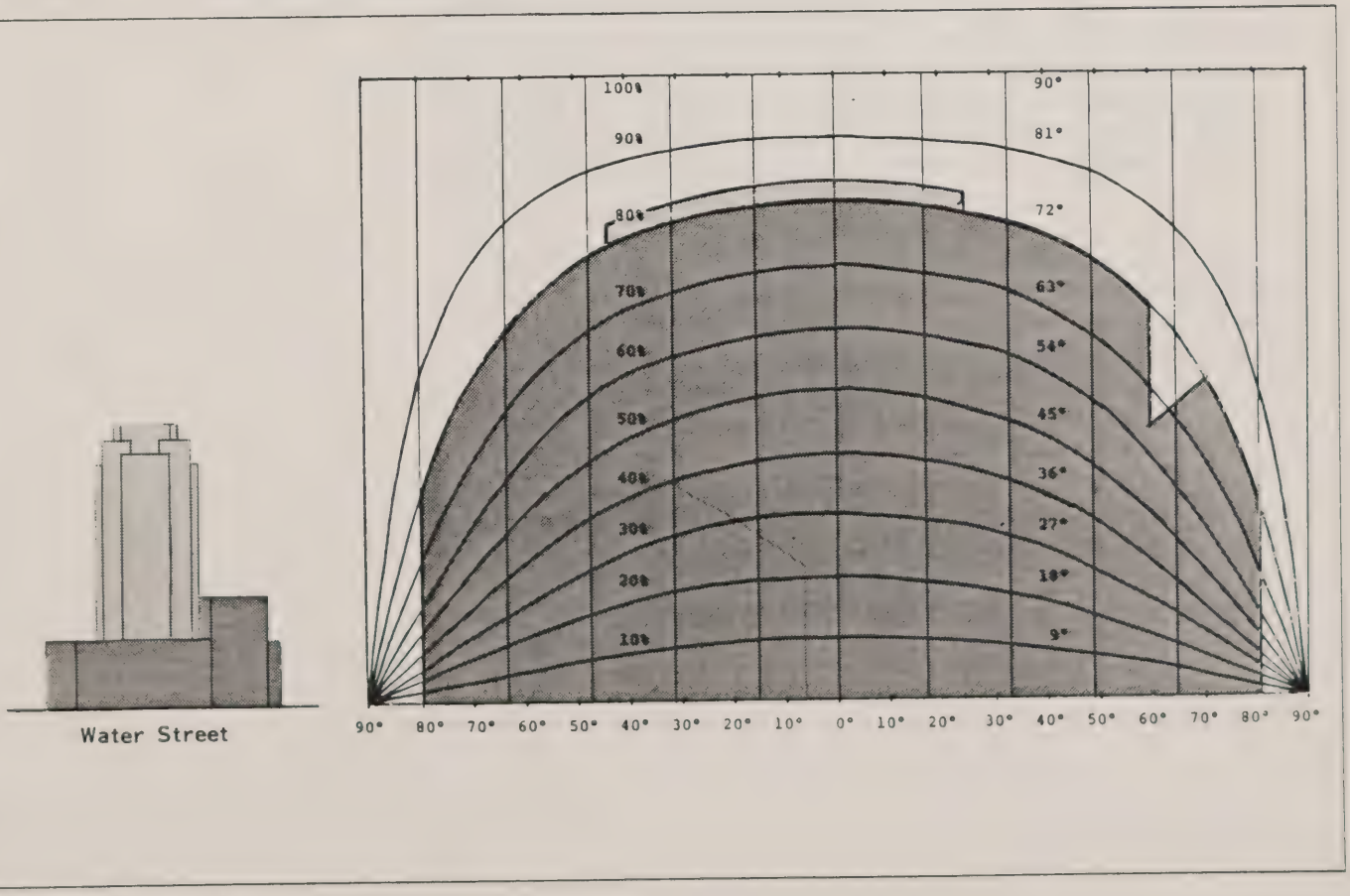


Alternative 3 View D 81%

F Historic Resources

INTRODUCTION

This section of the Environmental Assessment discusses the consequences of the proposed undertaking with respect to architectural and cultural history. The contents include: a discussion of the historic setting; a description of existing conditions; a summary of the significance of historic resources in the vicinity; an assessment of the impact upon historic features associated with various project alternatives; and identification of various mitigation measures.

HISTORIC SETTING

Origins

The project site stands at the eastern edge of the original Shawmut Peninsula shoreline, near the head of State Street, an historic artery which has connected Boston's waterfront to its commercial and mercantile core since the founding of the city. Commenting upon State Street, which was known as King Street in colonial times, the distinguished Boston historian, the late Dr. Walter Muir Whitehill, noted that the T Wharf addition at the foot of State Street, circa 1710, "was the obvious avenue to Boston from the part of the world that really mattered." Whitehill commented on recent developments in the financial district, making the following observations about this central spine of former counting houses and present-day commercial buildings.

> "A block away State Street continues to be the financial center of the city. The harbor was once nearer, for here, more than anywhere else in downtown Boston, land has encroached upon water. Much of today's State Street was once the Long Wharf, jutting into Town Cove. What one could see of the harbor a few years ago is now obscured by the omnipresent overhead highway, but the east wind still brings the Bostonian from the sea, as David McCord has remarked, 'its cooling quality and the faint and, to him, quite pleasing smell of distant fish." In the colonial period the intersection of State and Washington Streets was the nerve centre of Boston.'

Site

The proposed site is a 59,861 square foot parcel at the corner of State and Kilby Streets. It occupies the northwest portion of a major block bounded by State, Kilby, Broad and Water Streets. This block encompasses one intervening vehicular street, Doane Street, which is proposed to be closed.

Structures on Site

Existing structures on the site include:

75 State Street, a surface parking lot containing a small photo-processing outlet;

83-85 State Street, circa 1920, a four-story, four-bay commercial building which has been substantially altered at its storefront level;

89 State Street (the Fiske Building), circa 1888, a massive sixteen-story granite-faced Romanesque office building by Peabody and Stearns, whose dominant tower was removed in 1964 when it was refaced in aluminum and glass curtain wall concurrent with the addition of four contemporary stories in place of the former tower;

97-99 State Street (the Fiske Annex), circa 1903, a slender, five-story commercial structure of broad glass bands surrounded by masonry with classical revival decoration and a new storefront, circa 1980.

5-23 Doane Street, circa 1919, a seven-story commercial building with classical elements;

14-20 Kilby Street, circa 1922, a late example of Second Renaissance Revival style common to Boston's commercial architecture erected as a nine-story addition to its abutter, the aforementioned 5-23 Doane Street Building;

30-36 Kilby Street, a mid-twentieth century parking garage owned by the City of Boston.

Significance of Structures on Site

The architectural and historical significance of the properties on site, within the footprint of the proposed development, have been evaluated in accordance with two recognized statutory criteria: (i) eligibility for listing in the National Register of Historic Places; and, (ii) suitability for designation by the Boston Landmarks Commission as Local Landmarks or as contributory to a Local Landmark District.

Within the footprint, one structure, 97-99 State Street, is listed in the National Register of Historic Places by virtue of its contribution to the Custom House Historic District. This District, a large and diverse array of nineteenth and twentieth century structures, including some very noteworthy and distinguished properties, is discussed elsewhere in this Section. Other properties within the footprint are not considered eligible for individual listing in the National Register of Historic Places by the Massachusetts Historical Commission or by the Boston Landmarks Commission.

With respect to Local Landmark status, the findings of the professional survey team organized by the Boston Landmarks Commission to undertake its Central Business District Survey rated all structures within the footprint of the proposed development as Type V, "Minor Significance". This category is reserved for properties which have little individual historical or architectural significance, are substantially altered, and/or make a minor contribution to the overall context and streetscape of the central city. The Commission, which has adopted its survey findings as City policy, rated the garage at 30-36 Kilby Street a Type VI, indicating no preservation significance for this property.

Conversations with representatives of both the Massachusetts Historic Commission and the Boston Landmarks Commission have indicated a desire to resolve the condition and extent of original building fabric presently concealed behind a contemporary facade at the Fiske Building, 89 State Street. Preliminary investigations have revealed that the highly articulated tower portions of the original cornice and some projecting detail were destroyed in 1964. Much of the upper stories of the major facade on State Street remain,

albeit in a damaged state, owing to the curtain wall attachments. Further investigation and documentary research into this issue is currently being conducted.

Surroundings

The immediate surroundings of the proposed project include nineteenth and twentieth century commercial structures to the south fronting on Liberty Square, to the east facing Broad Street, and on the north side of State Street. Two late twentieth century office towers also are nearby: Sixty State Street to the northwest and Exchange Place immediately to the west, the latter of which encompasses the preserved portion of the Old Boston Stock Exchange Building as well.

Nearby Historic Resources

Within the immediate vicinity of the project site lie numerous noteworthy historic resources (see Exhibit IV F-2) including the following:

- Faneuil Hall Market District, to the north, is a six-acre auto-free zone encompassing Faneuil Hall, a National Historic Landmark designed by John Smibert in 1742 and enlarged by Charles Bulfinch in 1808, as well as three National Register properties designed in the Greek Revival style by Alexander Parris in 1824-26, the central "Quincy Market" building, and the flanking North and South market buildings. These former mercantile structures were recycled in 1968-75 and now enjoy international acclaim as a specialty retail, entertainment and commercial office development of enormous vitality and popularity.

- The Old State House, at the head of the State Street intersection with Congress Street, which is also the locus of the Boston Massacre. Built as the seat of pre-revolutionary government in Massachusetts in 1711, the Old State House was reconstructed in brick in 1747 after a fire. The Old State House now houses the collections and exhibits of the Bostonian Society. It is a National Historic Landmark and a popular stop for tourists along the Freedom Trail, a self-guided walking tour of central Boston's major 18th and 19th century landmarks.

Exhibit IV F-1

CUSTOM HOUSE NATIONAL REGISTER HISTORIC DISTRICT

Properties of Principal Interest:

1. Broad St. Associates Building
2. Central Wharf
3. Custom House
4. Flour and Grange Building
5. State St. Block
6. 50-54, 109-133 Broad
7. 99-101 Broad, 28-36 Merchant Row
8. Chadwick Lead Works
9. The Harvard Club
10. 114 State Street

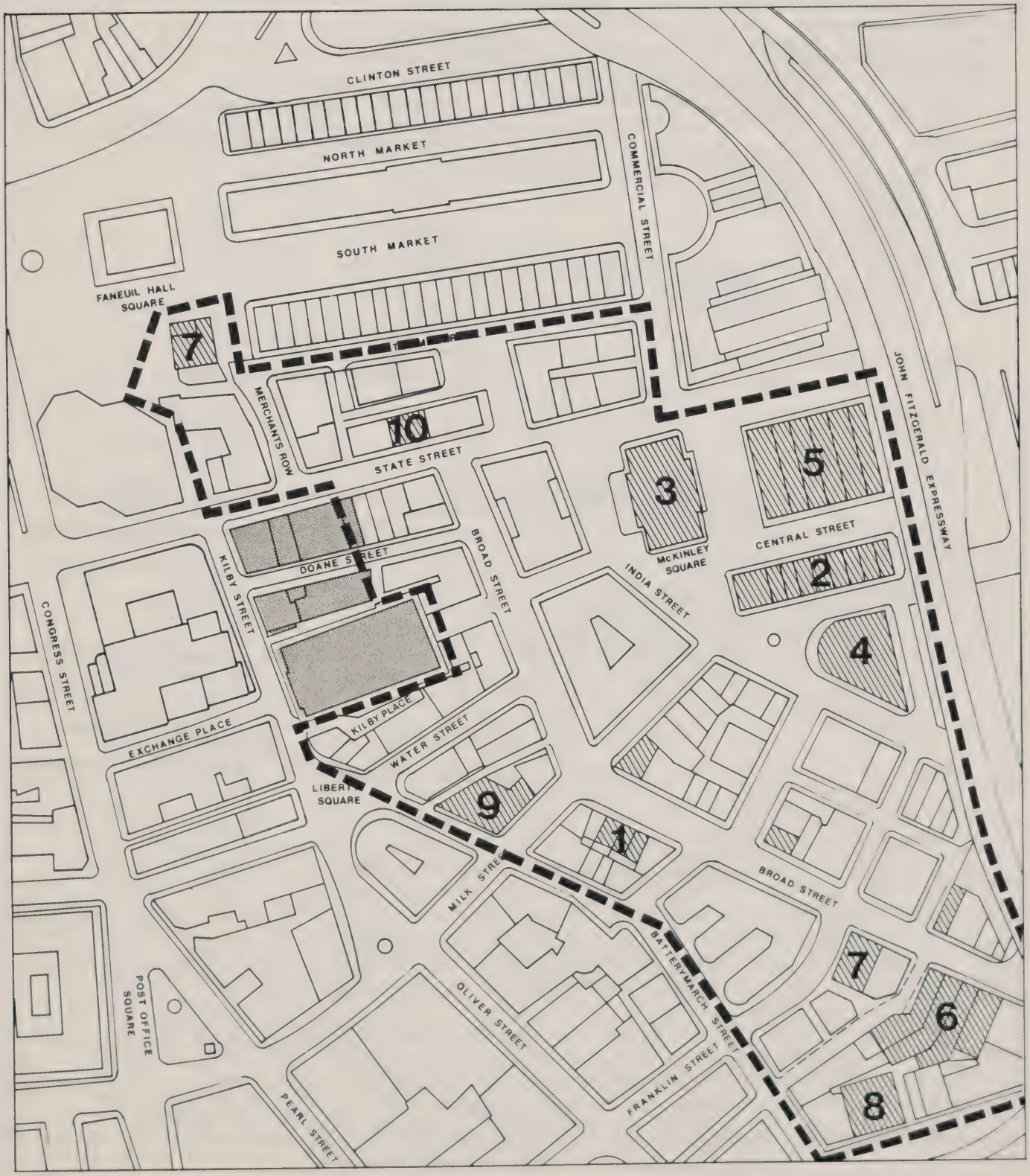
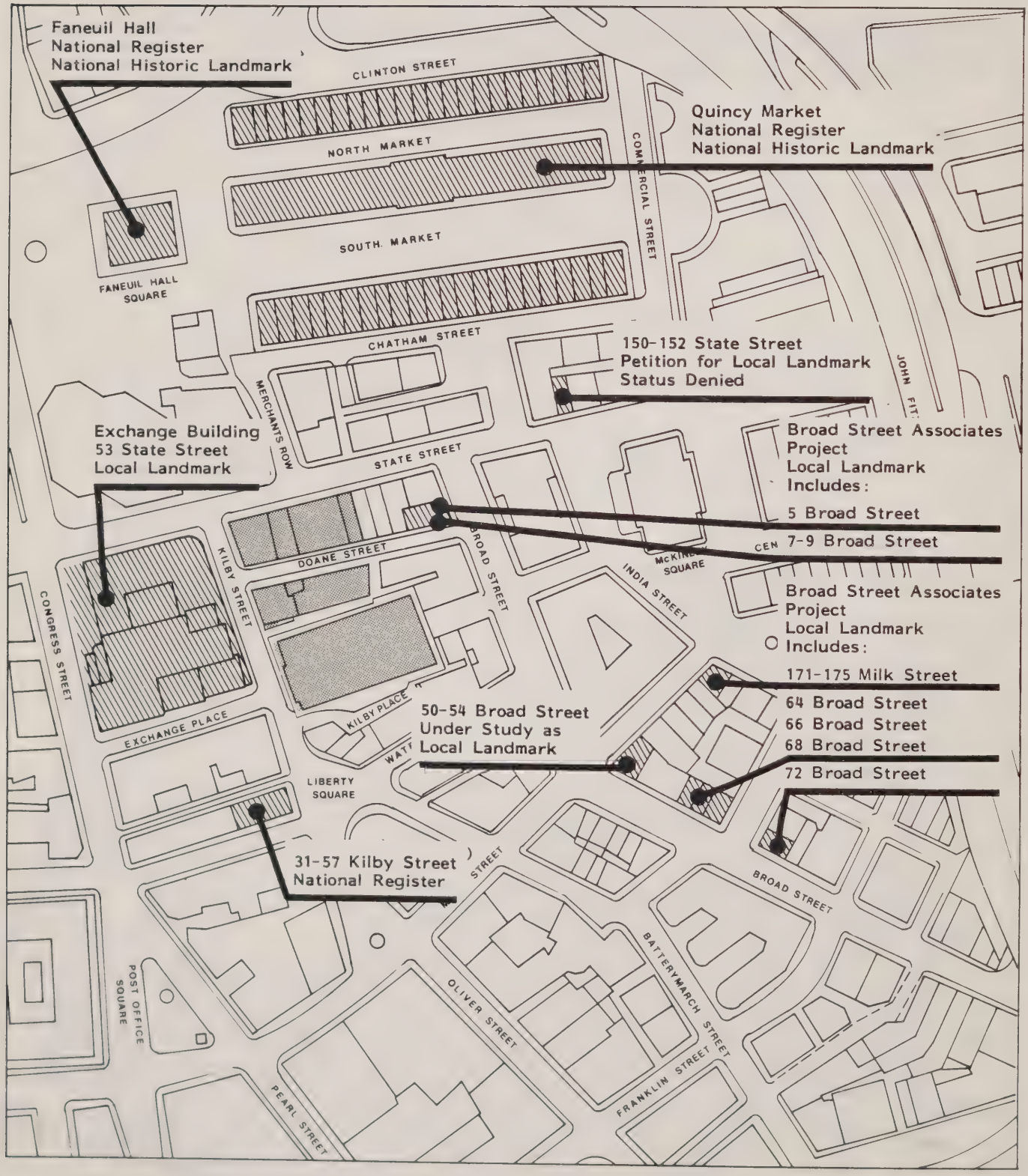


Exhibit IV F-2

HISTORIC DESIGNATIONS IN PROJECT AREA
(See also Custom House District Map)



- Custom House National Register Historic District (see Exhibit IV F-1) to the east, comprising approximately 16 acres of mixed commercial architecture reflecting Boston's development as a major mercantile city, including ten noteworthy structures depicted on Exhibit IV F-1. These include the Custom House itself, Central Wharf, the Grain and Flour Exchange, as well as several surviving Bulfinch buildings.

- Liberty Square, to the south, an intact ensemble of noteworthy late nineteenth and early twentieth century buildings which has recently experienced a series of rehabilitations for office and retail use.

- Post Office Square, to the southwest, a major open space in the CBD proposed for substantial upgrading, with park construction to occur on the site of the present parking garage.

Archaeological Resources

Preliminary inquiries to the City of Boston archaeologist and to the Massachusetts Historical Commission are presently inconclusive with respect to the prospects for finding significant pre-history or recent history artifacts below grade. These discussions will continue with further research to ensue during the approvals process for the proposed project.

IMPACTS

Primary Impacts

Any potential primary impacts of the proposed development upon historic resources would result from new construction on a site partially occupied by existing buildings and from construction procedures to be used to create the foundations and the below-grade levels of the proposed project. At issue is whether these activities have a direct effect on historic resources. Primary impacts include:

- Demolition of six existing buildings is proposed. Five of these lack standing as historic resources warranting retention; further study of the preservation and reuse of the facade of 99 State Street is under consideration as detailed project design ensues.

- Potential archaeological impacts as noted above could result from project excavation.

Secondary Impacts

The project is anticipated to have secondary effects on its historic surroundings as follows:

- Scale of new construction, both at the State Street and Kilby Street streetscapes and by virtue of the setback tower above: The maintenance of a consistent five-story cornice height along both streets, as envisioned in Alternatives 2 and 3, has a beneficial effect on the streetscape and upon the enduring scale of adjacent historic resources to remain.

- Views and vistas of surrounding historic structures as influenced by the massing of the proposed development: The prominence of the major vertical historic feature in the vicinity, the Custom House Tower, will be greatly enhanced from the heavily-travelled intersection at State and Congress Streets by all design options under consideration. Alternatives 2 and 3 are most effective in this regard, creating a scenic vista of considerable importance to the relationship between the Custom House Historic District and the locus of the Old State House.

- Pedestrian circulation to and from historic properties and streetscapes in the vicinity: The unification of pedestrian circulation to and through the proposed project via Merchants Row, Central Street and Exchange Place is a highly desirable effect of the development.

- In assembling the land for the 99 State Street Project, the developers have also gained restrictions on additional development on most neighboring structures. This will preclude significant additional development in the block.

- Shadow effects of any of the massing alternatives are minimal (see Section IV-D).

MITIGATION

Mitigation methods contemplated to address the impacts noted above include:

- Low-rise massing of the base block element and setback of tower with configuration to minimize shadow impact.
- Design of streetscape components of the project to respond sympathetically to the streetscape context at State Street and Kilby Street.
- Reinforcement of circulation patterns at the ground level which respond to pedestrian movements to and from Merchants Row, Exchange Place and Central Street.
- Acquisition of height restrictions on adjacent and abutting properties to the east which will preclude significant additional development in the block.
- Refinement of the design articulation, including choice of materials, scale and rhythm of fenestration, etc. intended to assure a compatible presence in the neighborhood.
- Ongoing contact with reviewing authorities and community groups throughout the forthcoming design and development implementation phases.
- Ongoing research into archaeological concerns, with the conduct of an approved data recovery program as appropriate.

G Construction

INTRODUCTION

The following section discusses potential impacts and mitigation strategies associated with the construction of the 99 State Street Project. The project's construction phase is currently planned to begin in 1986 and to last approximately 30 months, during which the impacts discussed below can be expected to occur. In addition to impact mitigation strategies presented here, the Project Proponent will work on an ongoing basis with the Boston Redevelopment Authority to develop a construction plan which ensures the maintenance of the area's environmental quality.

FOUNDATION CONDITIONS

The site is located immediately east of the colonial Boston shoreline (see Exhibit IV G-1). During the development of Boston, wharves were constructed from land out into the Boston Basin. The wharf line of 1795 intersected the southeast corner of the site, with the majority of the site lying landside of the wharf line. Therefore, the site is primarily land filled prior to 1795. Fill in the site area is underlain by organic silt and clay.

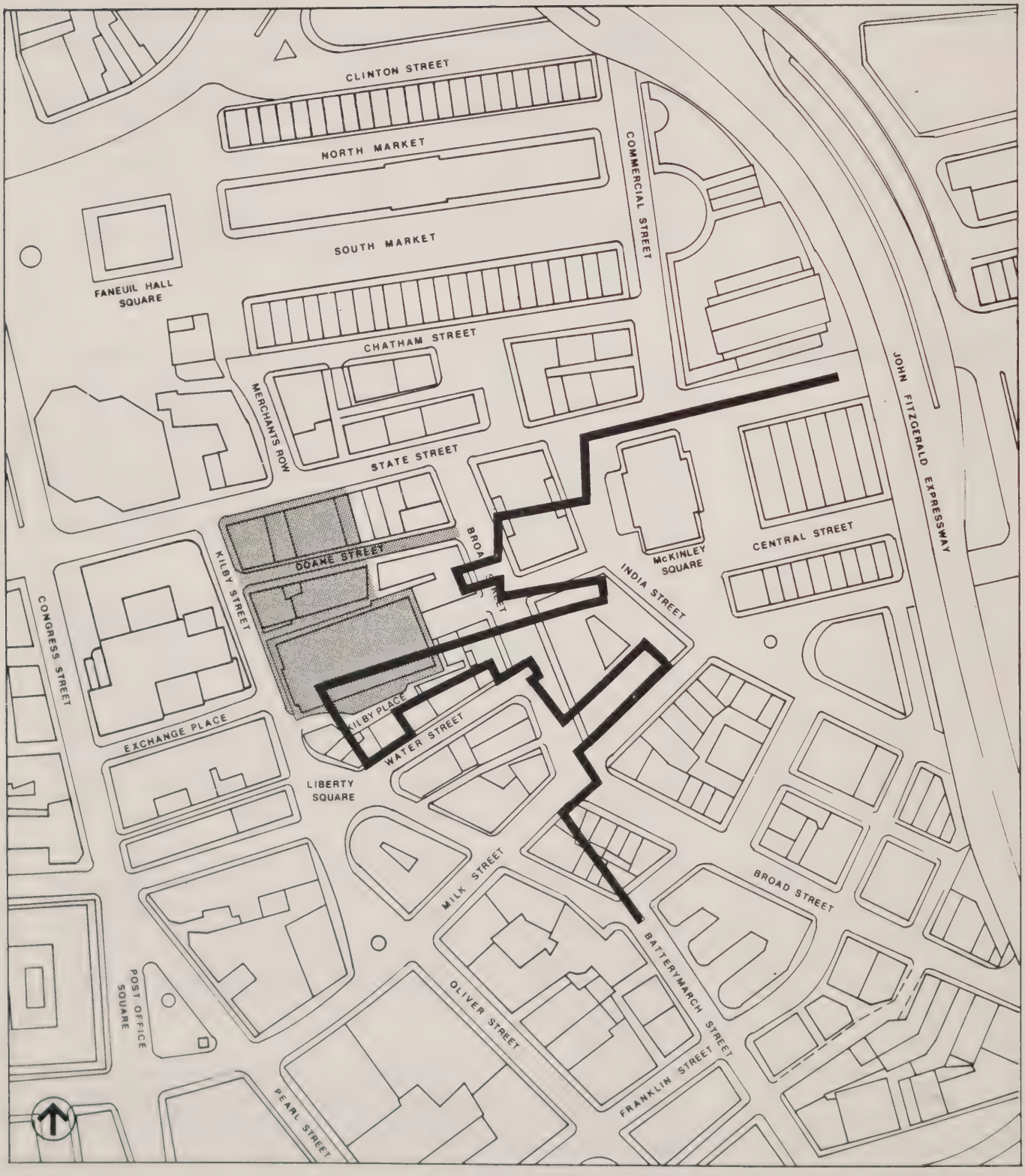
Based on the proposed building configuration, the foundation construction will require an extensive excavation to be made within the limits of the site. Excavation of areas below adjacent sidewalks is also under consideration. The site is currently occupied by existing buildings to be demolished. Therefore, the remnants of basement floors, walls, foundations, as well as abandoned utilities will have to be removed as part of the general excavation. Excavated material will be properly disposed of off-site.

Construction of the basement and foundation will require an excavation extending to the property line adjacent to State and Kilby Streets and set back a few feet opposite the adjacent buildings. Utilities are present below adjacent streets, and the MBTA Blue Line tunnel is located parallel and beneath State Street. No impact on MBTA operations will occur as a result of excavation.

Due to space constraints, an open sloped excavation is not feasible. Instead, a lateral earth support system will be utilized around the entire excavation. The type and design of the soil retention system will be

Exhibit IV G-1

1795 WHARF LINE*



1"=200'

*Approximate Location
(Source: Haley & Aldrich, Inc., Preliminary Geotechnical Study for Proposed 99 State Street Development)

compatible with subsurface conditions and will also provide adequate support for the existing adjacent structures, streets and utilities.

In consideration of these factors, a braced or tied-back concrete diaphragm wall constructed by the slurry trench method (slurry wall) is planned to be utilized as the most technically feasible method. This method will provide greater stiffness than would systems such as soldier piles or sheet piling, allowing only a small magnitude of ground movement and mitigating any need to underpin adjacent structures. A preconstruction survey of adjacent structures will be conducted in order to monitor any changes in physical condition of these structures during the construction period. Other advantages of this foundation system -- discussed more fully in the following sections -- include the minimization of noise and vibration associated with foundation systems using soldier piles or sheet piles, and the reduction of groundwater seepage during and following construction.

GROUNDWATER

The excavation is expected to extend below the groundwater level at the site. The use of a concrete diaphragm foundation wall will provide a cut-off barrier to horizontal water seepage, thus hydraulically isolating the excavation and minimizing any potential impact on the area's water table. It is anticipated that open pumping or other dewatering methods can be used to handle any seepage which does enter the excavation. Such water could be filtered or passed through sediment detention tanks before being discharged into the City storm sewer or pumped into a groundwater recharge system, if necessary. It is anticipated that the contractor will be required to obtain a dewatering permit from the BWSC before undertaking such actions. In addition, an instrumentation program will be undertaken during the construction period in order to monitor site area groundwater levels.

TRAFFIC

Traffic impacts during the construction period will be generated primarily by trucks delivering materials or removing debris from the construction site. In order to minimize effects on area traffic operations, speci-

fic truck routes to and from the Southeast Expressway will be designated. Such routes will be selected to minimize conflicts with area traffic, and to ensure adequate roadway geometrics in order to avoid delays from truck turning maneuvers at tight corners. In addition, spillage of waste materials onto roadway surfaces will be monitored and controlled.

Because the Kilby Street Parking Garage will be closed during the construction period, a substantial generator of area traffic will be eliminated. As a result, the addition of truck traffic during construction is not expected to increase area congestion or to decrease the level of service of area intersections beyond current levels. Traffic on Kilby Street seeking to avoid construction-related activity will be able to utilize Exchange Place to gain access to Congress Street. Doane Street will be closed during the construction period.

In addition, all area pedestrian flows will be maintained during construction, to the degree consistent with public safety requirements.

NOISE

Construction of the project as planned will entail a variety of temporary noise producing activities, including the demolition of existing buildings on-site. Land uses to be affected by construction-related noise are primarily office and commercial, with more sensitive receptors, such as the Devonshire Apartments or the Quincy Market plaza area, a substantial distance from the site and separated from noise-producing activities by large downtown structures.

A variety of mitigation measures, described in the following paragraph, will be utilized in order to ensure that temporary noise-related effects to businesses in the vicinity of the site are minimized, and to ensure that construction activity complies with Boston's construction site noise restrictions (City of Boston Air Pollution Control Commission, "Regulations for the Control of Noise in the City of Boston").

As previously discussed, one of the advantages of the foundation method under consideration for this project is that pile driving is generally not required, thus

minimizing one of the primary noise generators in the construction process. In addition, the contractor will utilize the quietest available construction equipment, with mufflers in proper operating condition. The temporary placement of solid walls surrounding the construction site will also help minimize noise in the immediate project area. Such walls, to be constructed of a heavy material such as plywood, will be tall enough to block views from ground level floor windows to ground level construction equipment. This height will be utilized because sound travels generally in straight lines, following the line of sight. In addition to noise mitigation measures to be undertaken by the contractor, masonry walls and closed windows of buildings can be expected to produce substantial noise attenuation during hours when most area business-people are indoors.

AIR QUALITY

During construction of the 99 State Street Project, short-term air quality impacts may occur. The sources of emissions generally associated with construction activity are construction equipment, fugitive dust associated with demolition and excavation, and automobile activity.

Heavy-duty construction equipment is expected to be mainly diesel and gasoline-powered. Expressed in terms of emissions per unit amount of fuel consumed, the gasoline engine typically produces up to 40 times as much carbon monoxide as the diesel. The diesel engine, on the other hand, produces between four and five times the amount of nitrogen oxides. Compared with the emissions from automobile sources around the 99 State Street Project area, it can be anticipated that direct emissions from construction equipment will be insignificant.

Another source of emissions that can be attributed to construction activity is automobile traffic related to transport of construction workers to and from the site, and to the potential disruption of existing traffic by the construction activity. However, because traffic currently generated by the Kilby Street Garage will not exist during construction of the project, traffic generated as a result of the construction process is not expected to increase congestion beyond existing levels,

and is not expected to adversely affect ambient air quality as compared with existing conditions.

Fugitive dust sources include dust generated by vehicle movements on unpaved road and other exposed surfaces, involving pulverization and abrasion of the surface materials by the vehicle's wheels, followed by entrainment of the dust particles by turbulent air currents. The rate of emission has been found to be proportional to the amount of vehicle travel on these surfaces, the silt content of the surface material, and the speed of travel. To the extent that the construction project will at times involve cleared land that will be unpaved and exposed, and that vehicular traffic will be going in and out of the unpaved lot, impacts to ambient air quality may develop with fugitive dust emissions during the construction stages. Therefore, the normal construction practice of wetting the exposed areas and of covering up dust-producing materials during transport will be implemented to minimize fugitive dust emissions.

Other mitigation measures to be utilized to minimize air quality effects will include minimization of storage of loose construction spoils on-site; location of aggregate storage piles away from areas having greatest pedestrian activity; placement of temporary retaining walls around the cleared site to reduce wind erosion; minimization of transfers and disturbance of loose materials; and use of covered trucks.

SUMMARY

Mitigation measures to minimize construction-related impacts will include the following:

Foundation Conditions

- Proper disposal of excavated materials.
- Use of slurry wall foundation to minimize ground movement and to protect adjacent structures.
- Preconstruction survey of physical condition of adjacent structures, and monitoring during construction.

Groundwater

- Use of concrete diaphragm foundation to minimize groundwater seepage.

- Monitoring of groundwater levels during construction.

Traffic

- Elimination of on-street parking on State Street, if necessary, to maintain the roadway's carrying capacity.
- Designation of truck routes between site and Southeast Expressway.
- Closing of Kilby Street Garage during construction period.
- Maintenance of area pedestrian flows during construction, to the degree consistent with public safety requirements.

Noise

- Choice of foundation method which does not require pile driving.
- Use of quietest available equipment with mufflers in proper operating condition.
- Use of temporary noise barriers around site.

Air Quality

- Wetting of exposed areas.
- Minimization of storage of loose materials on-site; location of storage away from pedestrian areas.
- Temporary retaining walls around site to reduce wind erosion.
- Use of covered trucks.

V Measures to Mitigate Adverse Impacts

TRAFFIC AND PARKING

- Relocation of existing garage entrance/exit from Kilby Street to Doane Street (via Broad Street), resulting in the removal of traffic from the area's most congested intersections.
- Placement of loading and receiving facilities at Kilby Place, away from traffic utilizing surrounding streets.
- No increase in parking beyond current number of spaces on-site.
- Improved garage ticketing operations resulting in shortened queuing periods for vehicles waiting to park on-site.

WATER AND SEWER SERVICES

- Relocation of water and sewer facilities located in Doane Street.
- Separation of sewage and stormwater lines in all relocated facilities.
- Use of a sewage storage tank system designed in compliance with BWSC requirements.
- Use of grease traps at any restaurant kitchen facilities.
- Use of oil/gasoline traps at discharge point of garage drainage system.

HISTORIC RESOURCES

- Use of low-rise base element and set-back tower configured to minimize shadow and the obstruction of daylight, establish a consistent cornice line along State Street and create a new vista of the historic Custom House Tower seen from State and Congress Streets.
- Design of streetscape components to establish coherent State Street frontage.
- Establishment of circulation patterns which reinforce pedestrian movements to and from Merchants Row, and between Broad Street and Kilby Street.

- Acquisition of height restrictions on adjacent and abutting properties, precluding significant additional development in the block.

- Choice of materials, scale and rhythm of fenestration to assure compatibility with development in the surrounding area.

WIND

- Ongoing wind tunnel analysis of project design.

SHADOW AND DAYLIGHT

- Use of setback tower element and lower base in order to minimize shadow effects and the obstruction of daylight.

CONSTRUCTION

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